RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

Vol. 62 MARCH, 1954 No. 3

CONGENITAL ABSENCE OF A PULMONARY ARTERY: ITS DEMONSTRATION BY ROENTGENOGRAPHY. *Stanley M. Wyman, M.D.* 321

CORRELATION OF UPPER LOBE VASCULARIZATION WITH CERTAIN CONGENITAL INTRACARDIAC SHUNTS. *N. G. Demy, M.D., and A. P. Gewanter, M.D.* 329

ROENTGEN ASPECTS OF ISOLATED VALVULAR PULMONIC STENOSIS. *S. Gilbert Blount, Jr., M.D., Malcolm C. McCord, M.D., Seiichi Komesu, M.D., and Raymond R. Lanier, Ph.D., M.D.* 337

RADIOLOGIC DETECTION OF A CALCIFIED THROMBUS WITHIN THE LEFT VENTRICLE. REPORT OF A CASE WITH SURGICAL VERIFICATION. *J. Stauffer Lehman, M.D., and Joseph L. Curry, M.D.* 344

KARTAGENER'S TRIAD. REPORT OF TWO CASES. *T. A. Gross, M.D.* 347

GASTRO-OESOPHAGEAL INCOMPETENCE IN CHILDREN. WITH SPECIAL REFERENCE TO MINOR DEGREES OF PARTIAL THORACIC STOMACH. *Roy Astley, M.B., D.M.R., and Ivo J. Carré, M.R.C.P., D.C.H.* 351

THE ROENTGEN DIAGNOSIS OF GALLSTONE ILEUS. *Thomas W. Dorr, M.D.* 363

THE PURGED COLON. *F. C. Jewell, M.D., and John R. Kline, M.D.* 368

VALUE OF PLAIN FILM IN RENAL MASS LESIONS (TUMORS AND CYSTS). *Alice Ettinger, M.D., and Milton Elkin, M.D.* 372

DISSOLUTION OF THE INTERVERTEBRAL DISK IN THE AGED NORMAL. THE PHANTOM NUCLEUS PULPOSUS. *J. Gershon-Cohen, M.D., Harald Schraer, Ph.D., David M. Sklaroff, M.D., and Nathan Blumberg, M.D.* 383

A MECHANISM OF THE PRODUCTION OF PSEUDOFRACTURES IN OSTEOMALACIA (MILKMAN'S SYNDROME). *Howard L. Steinbach, M.D., Felix O. Kolb, M.D., and Rutherford Gilfillan, M.D.* 388

OSTEOMYELITIS OF THE SPINE FOLLOWING PROSTATIC SURGERY. *Edward De Feo, M.D.* 396

OSTEITIS ISCHII AND PUBIS FOLLOWING ABDOMINOPERINEAL RESECTION FOR CARCINOMA OF THE RECTUM. *Alexander Lewitan, M.D., and Louis Nathanson, M.D.* 402

PROGRESSIVE EXOPHTHALMOS FOLLOWING THYROIDECTOMY CURED BY IRRADIATION OF THE CEREBRAL CENTERS. *Dr. A. Tevfik Berkman* 406

MORTALITY IN SWINE EXPOSED TO GAMMA RADIATION FROM AN ATOMIC BOMB SOURCE. *John L. Tullis, Comdr., MC, USN, Baldwin G. Lamson, Lieut., MC, USNR, and Sidney C. Madden, M.D.* 409

BODY-SECTION RADIOGRAPHIC EQUIPMENT: MODIFICATIONS AND ACCESSORIES. *W. Berkeley Zinn, M.D.* 416

ABSORPTION OF X-RAYS BY TISSUES OF THE HEAD AND NECK. *M. G. Wheatcroft, Comdr., DC, USN, and J. E. Morgan, Comdr., MSC, USN* 423

EDITORIAL: TRENDS IN MODERN MEDICINE. *Ira H. Lockwood, M.D.* 427

ANNOUNCEMENTS AND BOOK REVIEWS. 430

RADIOLOGICAL SOCIETIES: SECRETARIES AND MEETING DATES. 435

ABSTRACTS OF CURRENT LITERATURE. 439

RADIOLOGY

A MONTHLY PUBLICATION DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

PUBLISHED BY THE RADIOLOGICAL SOCIETY OF NORTH AMERICA

EDITOR
HOWARD P. DOUB, M.D.
Henry Ford Hospital, Detroit 2, Mich.

ASSOCIATE EDITORS
Hugh F. Hare, M.D.
Leo G. Rigler, M.D.
Laurence L. Robbins, M.D.

EDITORIAL ASSISTANTS
Marion B. Crowell, A.B.
Florence E. Roper, A.B.

PUBLICATION COMMITTEE
George L. Sackett, M.D., Chairman
Robert P. Barden, M.D.
James W. J. Carpender, M.D.

ADVISORY EDITORIAL BOARD
Richard H. Chamberlain, M.D.
Harold Cummins, Ph.D.
Edith H. Quimby, Sc.D.
Arthur Purdy Stout, M.D.

GENERAL INFORMATION

RADIOLOGY is entered as second class matter at Syracuse, New York, and Easton, Penna., under the Act of August 24, 1912, and accepted November 24, 1934. RADIOLOGY is published by the Radiological Society of North America as its official Journal. Subscription rate $10.00 per annum. Canadian postage, $1.00 additional. Foreign postage, $2.00 additional. Single copies $2.00 each. All correspondence relative to business matters connected with the Radiological Society of North America and RADIOLOGY, or remittance for non-member subscriptions, should be made payable to the Radiological Society of North America and should be addressed to the BUSINESS MANAGER, DONALD S. CHILDS, M.D., 713 E. GENESEE STREET, SYRACUSE 2, NEW YORK. In requesting change of address, both the old and the new address should be given.

Dues to the Radiological Society of North America include subscription to RADIOLOGY and should be paid to DONALD S. CHILDS, M.D., SECRETARY-TREASURER, 713 E. GENESEE STREET, SYRACUSE 2, N. Y.

The rate for "want" advertisements for insertion in the Classified Section is 8 cents per word, minimum charge $2.00. Remittance should accompany order. Rates for display advertisements will be furnished upon request.

Inquiries regarding the program for the Annual Meeting of the Society for the current year should be sent to the President.

RADIOLOGY is published under the supervision of the Publication Committee of the Radiological Society of North America, which reserves the right to reject any material submitted for publication, including advertisements. No responsibility is accepted by the Committee or the Editor for the opinions expressed by the contributors, but the right is reserved to introduce such changes as may be necessary to make the contributions conform to the editorial standards of RADIOLOGY. Correspondence relating to publication of papers should be addressed to the Editor, HOWARD P. DOUB, M.D., HENRY FORD HOSPITAL, DETROIT 2, MICHIGAN.

Original articles will be accepted only with the understanding that they are contributed solely to RADIOLOGY. Articles in foreign languages will be translated if they are acceptable. Manuscripts should be typewritten double-spaced, with wide margins, on good paper, and the original, not a carbon copy, should be submitted. The author's full address should appear on the manuscript. It is advisable that a copy be retained for reference as manuscripts will not be returned.

Illustrations and tables should be kept within reasonable bounds, as the number which can be published without cost to the author is strictly limited. For excess figures and for illustrations in color, estimates will be furnished by the Editor. Photographic prints should be clear and distinct and on glossy paper. Drawings and charts should be in India ink on white or on blue-lined coordinate paper. Blueprints will not reproduce satisfactorily. All photographs and drawings should be numbered, the top should be indicated, and each should be accompanied by a legend with a corresponding number. Authors are requested to indicate on prints made from photomicrographs the different types of cells to which attention is directed, by drawing lines in India ink and writing in the margin. The lines will be reproduced, and the words will be set in type. Attention should be called to points which should be brought out in completed illustrations, by tracings and suitable texts. These instructions should be concise and clear.

As a convenience to contributors to RADIOLOGY who are unable to supply prints for their manuscripts, the Editor can arrange for intermediate prints from roentgenograms.

Contents of RADIOLOGY copyrighted 1954 by The Radiological Society of North America, Inc.

RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

PUBLISHED BY THE RADIOLOGICAL SOCIETY OF NORTH AMERICA

Vol. 62 MARCH 1954 No. 3

Congenital Absence of a Pulmonary Artery: Its Demonstration by Roentgenography[1]

STANLEY M. WYMAN, M.D.

A CONDITION as uncommon as the congenital absence of a pulmonary artery merits attention for its rarity alone. It is possible that with more frequent antemortem recognition it may also become surgically important. Madoff, Gaensler and Strieder (6), in a very complete discussion of a case, presented the physiology and embryology of this condition and reviewed 9 cases previously described in the literature dating back to 1850. Of the 10 cases, all but 2 involved the right pulmonary artery; 3 had been diagnosed during life and 7 postmortem.

The present discussion adds 3 more examples of this anomaly, 2 of absence of the left pulmonary artery and 1 of the right. All 3 were demonstrated during life both by conventional roentgenograms and by angiocardiography. It seems evident that increasing use of contrast studies has disclosed a relatively large number of cases, so that the condition is not so rare as had been originally thought.[2] It is the purpose of this paper to emphasize the radiographic signs which establish the existence of the anomaly and differentiate it from other conditions at present correctable by surgery.

CASE I: The patient was a 15-year-old boy who had been entirely asymptomatic except for an occasional aching precordial pain lasting a few minutes, more marked when he lay down. His past history was otherwise negative.

Physical examination showed a rather pale, thin boy, unusually tall for his age. There were questionable clubbing of the fingers and a slight duskiness of the lips. The trachea was displaced to the left. Blood pressure in both arms was 120/60. The heart was much displaced to the left; sounds were of good quality. There was a Grade 1-2 systolic pulmonic murmur; aortic and pulmonic second sounds were equal. Good pulses were felt in both feet.

An *electrocardiogram* showed high-voltage R-waves in Leads V-4 and V-5, which were thought to be due to the unusual heart position.

Bronchoscopic findings were abnormal in that the tracheal tree deviated to the left, and a web-like, possibly vascular structure was seen at the distal end of the left main bronchus.

CASE II: The patient was a 6-year-old boy when first seen. His mother had had a normal full-term delivery following an uneventful pregnancy. It was noted that the infant became blue on crying during the first ten days of life, and his weight gain was slow. Cyanosis on crying and slight duskiness of the lips persisted, along with easy fatigability and one-flight dyspnea. There had been one episode of alleged hemoptysis.

Physical examination disclosed a small, thin, slightly ill-appearing, cyanotic child. The pulmonic second sound was increased, being greater than the aortic. A Grade 1-2 systolic murmur was heard in the pulmonic area, and there was a Grade 2 apical systolic murmur. Blood pressure was 110/70.

[1] From the Department of Radiology, Massachusetts General Hospital, Boston 14, Mass. Presented at the Thirty-ninth Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 13–18, 1953.

[2] Since the preparation of the present paper, the following report on this subject has appeared: Steinberg, I., Dotter, C. T., and Lukas, D. S.: Congenital Absence of a Main Branch of the Pulmonary Artery. J.A.M.A. 152: 1216–1218, July 25, 1953.

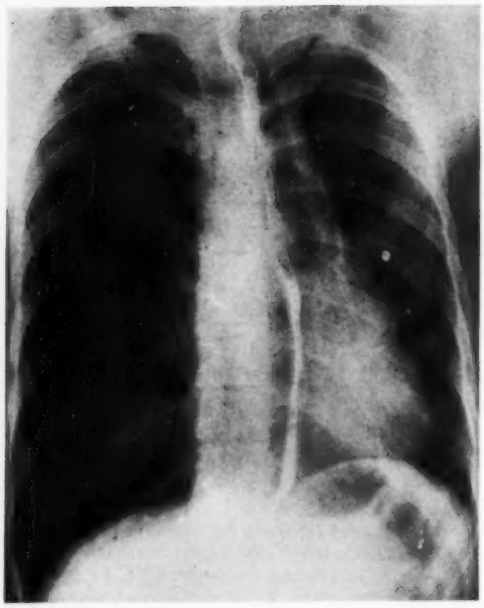


Fig. 1. Case I. Conventional postero-anterior roentgenogram.

The lungs were clear; the liver palpable. There was cyanosis of the fingers and toes, and slight clubbing was observed.

Because a sufficiently large catheter could not be introduced, *cardiac catheterization* was rather unsatisfactory. Simultaneous blood samples showed consistently lower oxygen content in the femoral artery sample than in that from the right brachial artery.

CASE III: A 20-year-old male student was admitted for observation. His birth had been normal and he had been in good general health until the age of ten, when it was noted that his breathing was wheezing in character and that he became dyspneic on climbing hills. Three years before admission he tended to become blue on exertion and dyspneic on going over two flights of stairs; examination revealed cardiac enlargement. One year prior to entry, the dyspnea and blueness became more noticeable, and clubbing, especially of the left fingers, developed. During the year the patient had experienced two hemoptyses, each time raising half a cup of dark red blood.

Physical examination revealed a fairly heavy, cyanotic, chronically ill-appearing young man. The pulse was 100, regular; the blood pressure in the right arm was 120/105; in the left arm 120/95; in the leg 140/120. There was moderate clubbing, more marked in the left hand and feet than in the right hand. The nails of the right hand were deep red. The lungs were clear; the heart enlarged, with normal sounds. There was a marked auricular (presystolic) sound along the left sternal border, more pronounced to the right of the lower sternum. No other murmurs were heard. The liver was palpable 9 cm. below the right costal margin. It was the examiner's impression that the patient had congenital heart disease with coarctation proximal to the left subclavian artery.

Cardiac catheterization showed a shunt of small size from right to left, evidenced by arterial oxygen unsaturation in the left radial artery (88 per cent).

Fig. 2. Case II. Conventional roentgenogram.
Fig. 3. Case III. Conventional roentgenogram.

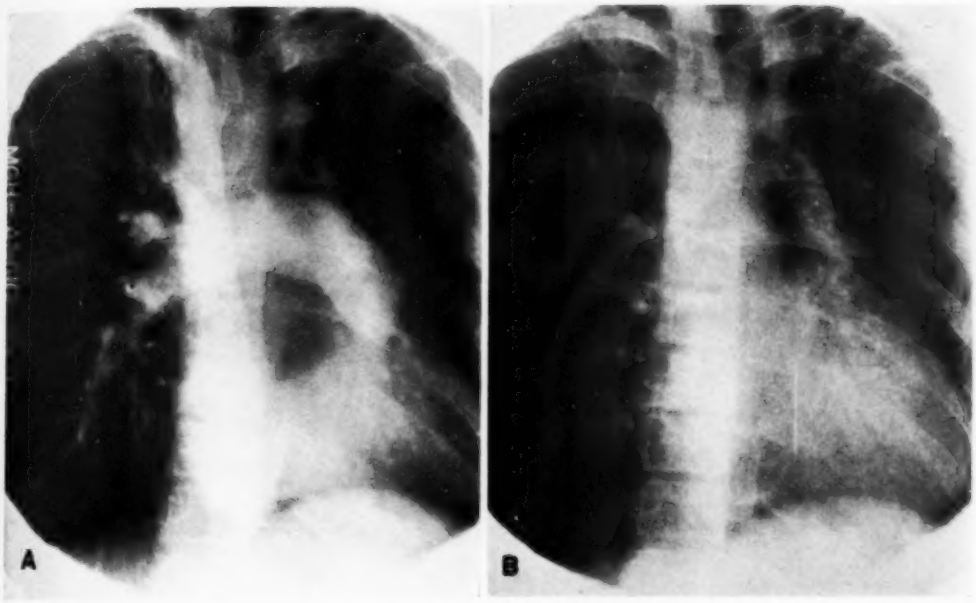


Fig. 4. Case I. A. Angiocardiogram taken about four seconds after injection of contrast material, showing normal right pulmonary artery and absence of the left branch. B. Taken about fifteen seconds after injection, showing accentuation of the lace-like pattern at the left hilus, representing bronchial arteries.

There were marked right ventricular systolic hypertension with elevated right ventricular end diastolic pressure (120/10) and high mean right auricular pressure, consistent with right ventricular failure. The existence of a patent ductus was not established with certainty.

Conventional Roentgenograms: In the plain postero-anterior roentgenograms of the chest in all 3 cases the hemithorax on the abnormal side appeared to be smaller than its mate. The rib interspaces were also smaller, the diaphragm was elevated, and the heart and mediastinum were displaced toward the affected side (Figs. 1, 2, and 3). In roentgenograms made with sufficient penetration, the pulmonary artery shadow was absent. Normally, the hilar arterial shadow presents as a branching system of broad vessels which produces the typical density seen at the hilus. In the 3 cases here presented, in the place of the normal pulmonary artery shadows a network of much smaller vessels was apparent, and these formed a lace-like pattern in striking contrast to the broad branching vessels usually seen (3). This vascular network is believed to be the branching bronchial arteries, and visualization of these vessels instead of the normal pulmonary arterial branches is characteristic of this condition (Figs. 1 and 8).

The abnormal hilus was difficult to see because of the displacement and rotation of the heart toward the affected side. The major bronchi appeared normal; in *Case I*, this was confirmed by bronchoscopy and in *Case III* by autopsy. In *Case I* and *Case III* herniation of the normal lung anteriorly toward the affected side was observed.

Roentgenoscopically there was no evidence of a shift of the mediastinum or heart with inspiration. This indicates that the smaller lung, though lacking a pulmonary artery, was aerating well. In *Case I* the heart shadow, except for its displacement and rotation, seemed normal. In *Case II* there were multiple associated congenital anomalies of the heart, as well as of the ribs and spine. In *Case III* there was considerable cardiac enlargment, which seemed to be chiefly right ventricular.

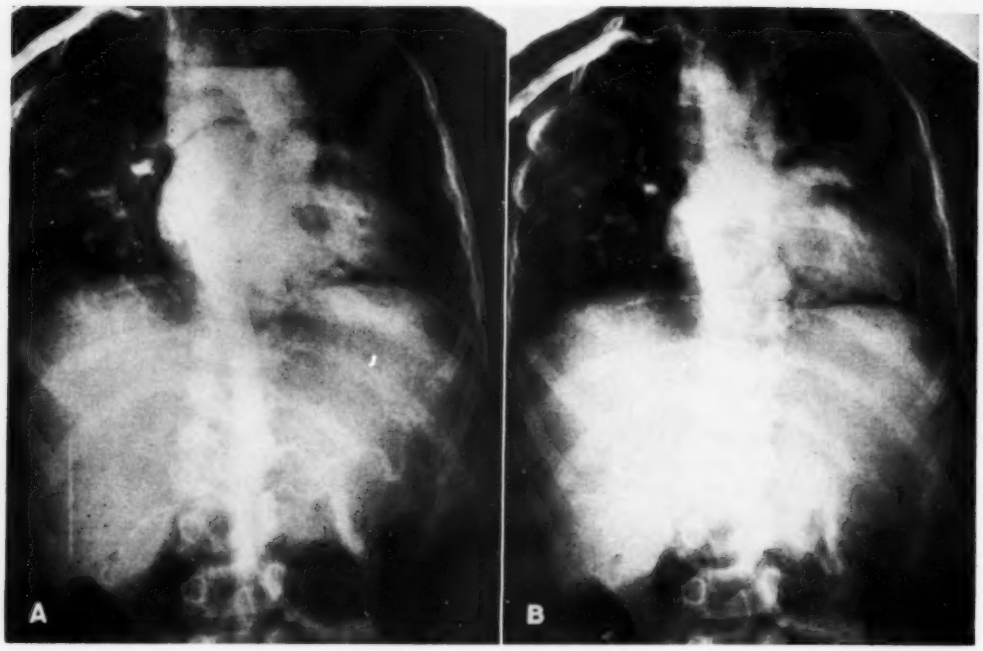


Fig. 5. Case II. A. Angiocardiogram taken about three seconds after injection of the contrast material. B. Taken about ten seconds after injection.

The initial diagnosis of absence of a main branch of the pulmonary artery was made from the conventional roentgenograms in *Case I;* in the other 2 cases, the cardinal roentgen findings were present and recognized on review.

The use of laminagraphy may demonstrate the true appearance of the vessels at the hilus to advantage, at the same time establishing the normalcy of the bronchi. Use of very high-voltage films (2,000 kv.), at present in an experimental stage, may also prove of value in this respect.

Angiocardiography: In all 3 cases angiocardiography was done in the usual manner, contrast material being introduced by a cannula in a vein in the right arm. The exposures were made with the patient in the horizontal position, the initial films being taken at the rate of three per second for two seconds and the later films at the rate of one every 0.7 second, by means of specially designed and manufactured apparatus (8).

In *Case I*, serial films of the heart showed prompt filling of the superior vena cava, right auricle, right ventricle, main pulmonary artery, and a normal appearing right pulmonary artery (Fig. 4A). There was no suggestion of a left pulmonary artery. Later films showed the appearance of the contrast material in the right pulmonary veins and subsequently in the left auricle, left ventricle, and aorta. At the time of opacification of the aorta, a fine, lacy network of vessels, interpreted as representing enlarged bronchial arteries, became more clearly visible at the left hilus (Fig. 4B). The angiocardiograms corroborated conclusively the findings noted on the conventional roentgenograms.

Angiocardiography in *Case II* showed a right-sided aortic arch and a large patent ductus, which measured nearly 1 cm. in diameter and conducted a large amount of the medium to the descending aorta. There was no suggestion of a left branch of the main pulmonary artery. A probable interventricular and possibly an interauricular septal defect were demonstrated

(Fig. 5A). A large bifid right pulmonary artery was evident, and normal appearing right pulmonary veins filled in the usual sequence. The left ventricle, the ascending aorta, and the great vessels to the head and arms were visualized. At the time of filling of the proximal aorta, a network of fine vessels in the left lung, presumably bronchial arteries, was accentuated (Fig. 5B).

In *Case III*, angiocardiograms delineated the superior vena cava, right auricle, and an enlarged right ventricle after delay of about eight seconds. A very large main pulmonary artery and a somewhat smaller than normal appearing left branch filled. No right pulmonary artery was evident. The branches of the left pulmonary artery remained filled until the end of the examination, about fifteen seconds. There seemed to be a minute amount of medium in the descending aorta in the later stages of the examination, without evidence of medium in the left auricle, ventricle, or proximal aorta. This suggested a patent ductus arteriosus. The slow transit of medium through the left lung made the possibility of coexisting diffuse pulmonary or arteriolar disease seem likely.

Two months later the patient died, and postmortem examination was performed elsewhere. The salient findings were:

Heart: The right ventricle was enlarged and its wall thickened, measuring 2 cm.; the left ventricular wall measured 1.5 cm. The pulmonary valve measured 9.2 cm. in circumference, the tricuspid 13.5 cm.; the mitral 9.5 cm., and the aortic 6.5 cm. *There was no right pulmonary artery.* The ductus arteriosus was the first branch of the pulmonary trunk, measuring 4 cm. in length; 1.5 cm. in outside diameter but only 1.5 mm. in inside diameter. The lumen was almost closed by a ring of sclerotic tissue. No thrombus was found. The left pulmonary artery was 2 cm. in circumference and contained a few atherosclerotic plaques. There was extensive thrombosis, both old and new, of the terminal arteries, with recanalization of some old thrombi. Secondary polycythemia was present. The ascending aorta was hypoplastic and there was an infantile type of coarctation of the aorta between the left carotid and subclavian.[3]

[3] This case will be discussed in a subsequent paper by Dr. Joseph P. Lynch.

Fig. 6. Case III. Angiocardiogram made about fifteen seconds after injection of opaque material.

DISCUSSION

Madoff *et al.* (6) have discussed at some length the therapeutic considerations of congenital absence of a pulmonary artery. It has been shown experimentally (1) that as much as one-third of the output of the left ventricle may go to the bronchial arteries of a lung in which the pulmonary artery has been ligated. It seems possible that the added burden of the increased bronchial flow might be an indication for resection of the involved lung. Findlay and Maier (5) suggest that this condition might place sufficient load on the heart to lead to failure. They add that, under some circumstances, hemorrhage in the lung resulting from the high systemic pressure in the bronchial arteries likewise could be an indication for removal of the lung. It seems unlikely, however, that the patient will have symptoms caused simply by congenital absence of a pulmonary artery. Symptoms, if present, are probably due to associated anomalies or to complications such as hemorrhage or cardiac failure. It might be difficult to persuade an asymptomatic patient in good subjective general health to undergo elective surgery even if such a course seemed

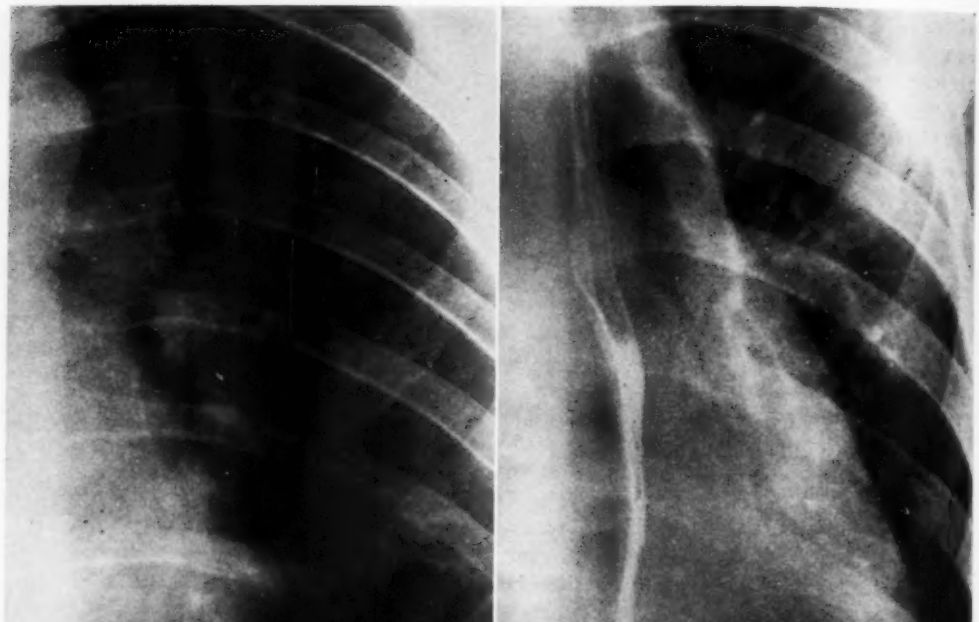


Fig. 7. Normal left hilus and pulmonary artery shadow.
Fig. 8. Case I. Detail view of left hilus, showing absence of normal pulmonary artery shadow and in its place the fine lace-like pattern of the bronchial arteries.

advisable. These considerations, however, are somewhat theoretical and, so far as is known, no case has been subjected to resection of a lung for these reasons, with the exception of one in which lobectomy was performed for hemorrhage (7).

It is important to recognize the condition for a number of reasons other than as a matter of academic curiosity. The chief of these is to differentiate it from other more common conditions, such as collapse of a lung or of a lobe. Differentiation from collapse produced by an adenoma, for example, may be difficult, but is necessary, since an adenoma calls for resection, while at the present time there is no clear-cut indication for surgery for absence of a pulmonary artery. Chronic thickening of the pleura due to old tuberculous pleuritis may result in decreased volume of the affected hemithorax with shift of the heart and mediastinum toward the affected side and elevation of the hemidiaphragm. This appearance may be quite similar to that of absence of a pulmonary artery except that with pleuritis a pulmonary artery should be visible, albeit perhaps smaller in caliber than normal.

A number of other conditions may be confused with absence of a pulmonary artery. The existence of normal bronchi must be established to exclude congenital absence of a lung (4). Differential diagnosis will depend in the last analysis upon identification of anatomical structures in the hilus. This may be accomplished with reasonable certainty by conventional roentgenography, or with greater assurance by laminagraphy, but ultimately angiocardiography becomes necessary to clarify the situation in the living patient.

It is of considerable interest that the pathologic files of the Massachusetts General Hospital do not contain a single in-

stance of absent pulmonary artery in approximately 16,000 autopsies (2). In contrast, in a relatively short period of time, angiocardiography has disclosed 3 cases. Nevertheless, the condition is certainly not common.

SUMMARY

Three cases of congenital absence of a pulmonary artery, recognized during life, have been presented. In 1 there were no known associated anomalies and the patient was essentially asymptomatic. In 2 there were extensive cardiovascular abnormalities, which in 1 instance led to death at the age of twenty and in the other caused retardation of growth and impairment of health.

The absence of a pulmonary artery and the coexistence of enlarged bronchial arteries can be recognized on conventional roentgenograms made with the proper degree of penetration. The true nature of the condition can best be established in the living individual by angiocardiography.

This anomaly is of considerable academic interest. Its identification and differentiation from conditions requiring surgical correction are of practical value.

Massachusetts General Hospital
Boston 14, Mass.

REFERENCES

1. BLOOMER, W. E., HARRISON, W., LINDSKOG, G. E., AND LIEBOW, A. A.: Respiratory Function and Blood Flow in Bronchial Artery After Ligation of Pulmonary Artery. Am. J. Physiol. **157:** 317–328, May 1949.
2. CASTLEMAN, B.: Personal communication.
3. COCKETT, F. B., AND VASS, C. C. N.: Collateral Circulation to Lungs. Brit. J. Surg. **38:** 97–103, July 1950.
4. FERGUSON, C. F., AND NEUHAUSER, E. B. D.: Congenital Absence of Lungs (Agenesis) and Other Anomalies of the Tracheobronchial Tree. Am. J. Roentgenol. **52:** 459–471, November 1944.
5. FINDLAY, C. W., JR., AND MAIER, H. C.: Anomalies of Pulmonary Vessels and Their Surgical Significance with Review of Literature. Surgery **29:** 604–641, April 1951.
6. MADOFF, I. M., GAENSLER, E. A., AND STRIEDER, J. W.: Congenital Absence of Right Pulmonary Artery. Diagnosis by Angiocardiography with Cardiorespiratory Studies. New England J. Med. **247:** 149–157, July 31, 1952.
7. SWEET, R. H., AND WHITE, P. D.: Quoted by Findlay and Maier (5).
8. WYMAN, S. M., AND SCHOLZ, F.: Preliminary Report on Radiography in Rapid Sequence. Radiology **57:** 748–751, November 1951.

SUMARIO

Ausencia Congénita de una Arteria Pulmonar: Descubrimiento con la Roentgenografía

Preséntanse 3 casos de ausencia congénita de una arteria pulmonar, reconocida durante la vida. En 1, no había otras anomalías conocidas y el enfermo era, esencialmente, asintomático. En 2, existían extensas anomalías cardiovasculares que, en 1 culminaron en la muerte a la edad de veinte años y en el otro ocasionaron retardo del crecimiento y falta de salud.

La ausencia de una arteria pulmonar y la coexistencia de arterias bronquiales hipertrofiadas pueden reconocerse en las radiografías corrientes con una penetración adecuada. En lugar de la ramificación normal de los vasos sanguíneos que produce una típica densidad en el hilio, obsérvase una red de vasos mucho más pequeños (presuntamente las ramas de las arterias bronquiales) formando un patrón a modo de encaje. El mejor modo de establecer la verdadera naturaleza del estado es con la angiocardiografía.

Esta anomalía no tan sólo posee mucho interés teórico, sino que reviste valor práctico su diferenciación de otras dolencias que exigen rectificación quirúrgica.

DISCUSSION

John A. Campbell, M. D. (Indianapolis, Ind.): Dr. Wyman has shown us another major cardiovascular anomaly which can be readily diagnosed by roentgen means. He has evaluated the usefulness of the various radiographic methods and found another specific indication for angiocardiography. A congenital absence of the pulmonary artery is admittedly rare, with some 12 cases being reported in the previous literature. A review of all of our autopsy material at Indiana University fails to show

a single case. Now that this condition can be identified roentgenologically, perhaps the true incidence will be more closely realized.

After Dr. Wyman showed me the angiographic evidence of this diagnosis last summer, I began to look more closely in our own material for such cases. My total experience with this diagnosis consists of two cases. The first demonstrates the limitation of the plain film findings and their lack of specificity, which is particularly noticeable in infants and young children. The patient was a four-month-old infant with slight cyanosis and rapid respiration since birth, worse with increased activity. The overpenetrated postero-anterior chest film showed the left lung to be smaller and more radiable than the right. The vascular markings were inconspicuous and the normal comma shadow in the left hilus was invisible. Angiocardiography, however, showed normal pulmonary arteries. Under the stress of this procedure, a marked obstructive emphysema of the left lung occurred, indicating a bronchial check-valve mechanism. The patient became seriously anoxic, and operation disclosed a small bronchial cyst, 2 cm. in diameter, compressing the left main stem bronchus. In the presence of diminished lung volume on the left side, we mistook the lack of pulmonary markings, which I think denotes emphysema, for avascularity.

In the second case, the criteria that Dr. Wyman has pointed out led us to the correct diagnosis—a smaller left chest, elevation of the left diaphragm, and lack of pulmonary artery shadow in this hilus. Angiocardiography showed complete absence of the left branch of the pulmonary artery in association with an overriding aorta and a high interventricular septal defect. The dilated right pulmonary artery was a continuation of the main pulmonary artery, which showed an aortic fenestration anomaly at its point of origin.

As regards the physiology of this condition, the affected lung ventilates normally and, in fact, has been shown to overventilate in many studies. The oxygen uptake and carbon dioxide output are always reduced, sometimes to levels of 1 or 2 per cent of the total, depending on the adequacy of the blood supply through the bronchial arteries and anomalous vessels. The effective bronchial arterial flow, however, may be increased. There is one important point incident to this. In an uncomplicated case, the bronchial arterial supply acts as an arteriovenous shunt and may cause some left ventricular strain, which conceivably could be an indication for removal of the lung on the side of the absent pulmonary artery. On the other hand, if we have a complicated case, such as the one I described with an overriding aorta and septal defect, the left-to-right shunt through the bronchial arteries of the affected lung serves the useful purpose of the Blalock principle and it would be an error to remove this lung.

One other point I would like to make is that I think it is necessary not to confuse certain other conditions with the one Dr. Wyman has described. He has mentioned the condition in which we have a main pulmonary artery and an absence of one of the branches to one of the lungs. We must distinguish this from such conditions as truncus or pseudotruncus arteriosus, in which the pulmonary arteries may arise from the descending aorta. Tetralogy of Fallot with complete atresia of one pulmonary artery also can give a somewhat similar picture as congenital absence of the same vessel.

I have two questions I would like to ask. One observer, Dr. Henry Kaplan (I don't know if he is in the audience here or not), mentioned that he has seen a case of absent pulmonary artery in which bronchoscopy showed widespread bronchial cystic malformations. Also, in sequestration of the lung, certain anomalies of the arterial and bronchial structures co-exist. In Dr. Wyman's first case mention was made of some type of web formation which the bronchoscopist saw in the left bronchus. I would like to ask him what relationship, if any, does congenital absence of the pulmonary artery have to bronchial malformations. Secondly, I would like to ask whether he knows how to explain the presence of the cyanosis and hemoptysis in uncomplicated cases of absence of the pulmonary artery.

Dr. Wyman (*closing*): I wish to thank Dr. Campbell for his helpful discussion.

In the matter of sequestration of the lung, as far as we know, it isn't a question of too few vessels; it's a question of too many. The six people that we have seen with sequestration of the lung have an added vessel supplying the sequestrated portion of the lung, coming either from below the diaphragm or from just above the diaphragm, arising from the aorta and serving as a pulmonary artery.

The second point, that of hemoptysis, I feel could be answered quite readily by the physiological fact that has been shown by Dr. Liebow in New Haven, namely, that these people who have cystic disease or bronchiectasis, or whatever you want to call it, do have very much enlarged bronchial arteries. The enlarged bronchial arteries are under systemic pressure and could provide a source for hemoptysis.

Correlation of Upper Lobe Vascularization with Certain Congenital Intracardiac Shunts[1]

N. G. DEMY, M.D., and A. P. GEWANTER, M.D.

DYSPNEA and cyanosis are diagnostic emergencies in the newborn. The most frequent clinical explanation is atelectasis or aspiration pneumonitis, and the radiologist is often hard pressed to make a preliminary diagnosis from the information available on the conventional film. In our experience, abnormal intracardiac shunts have been a frequent cause of alarming dyspnea and cyanosis, but the size and contour of the heart may be so normal at this period that the signs of anomalous blood flow through the lungs are overlooked or misinterpreted. Study of the distribution and the size of the peripheral vessels has greatly aided us in predicting the most probable type of anomaly, especially when serial films are obtained.

The pediatrician is occupied with the acute problem of keeping the newborn child alive, so that the more calculated aids of electrocardiography, fluoroscopy, laboratory studies, angiocardiography, and precise physical examination are not employed until the immediate danger has passed. Often fluoroscopy is not possible, or, if it is done, oxygen and mask are brought to the x-ray department with the patient. Thus, the simple roentgenogram may be the only means for presumptive diagnosis, treatment, and prognosis.

The following series of cases is presented from the point of view of the radiologist in a community hospital, who is called on to differentiate atelectasis and aspiration pneumonitis from congenital malformations of the heart and to make a presumptive anatomical diagnosis.

CASE I: P. K. was born Oct. 3, 1949, with poor color and appearance. Only slight cyanosis of the nail beds was noted. The heart was rapid, regular, and without murmurs. The clinical impression was congenital heart disease or atelectasis. Due to the patient's condition no laboratory studies were obtained. A roentgenogram (Fig. 1) shows an atypical left heart border and prominent hilar vessels. There is diminished aeration of the right upper lobe, apparently due to atelectasis. Bronchoscopy revealed no obstruction and no material in the bronchi. The child died Oct. 6.

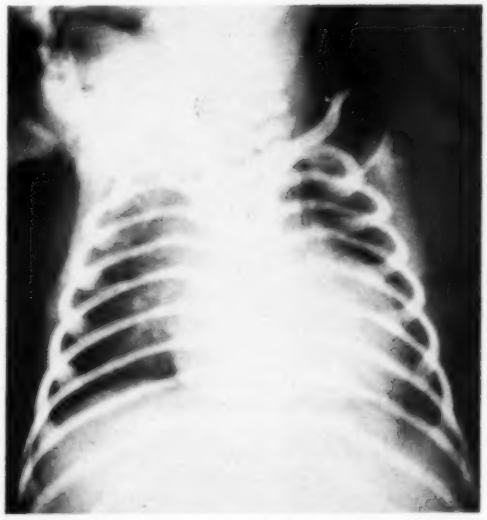


Fig. 1. Case I. Atypical left heart border and diminished aeration of right upper lobe.

Autopsy showed transposition of the great vessels. The pulmonary artery was 2.8 cm. in circumference; the aorta 2.0 cm. Large dilated branches passed directly to the right upper lobe. There was extreme dilatation of the right ventricle. The ductus arteriosus was short and widely patent, the foramen ovale was patent and measured 2.1 cm., and a small 3.0-mm. interventricular septal defect was present. There was no atelectasis or pneumonitis.

CASE II: E. M. was born Jan. 14, 1951. No abnormality was noted, and she was discharged on Jan. 18. She was readmitted on Feb. 1 with dyspnea, dehydration, and cyanosis. There were no murmurs, and the heart was normal on physical examination. The red cell count was 4,250,000 and the hemoglobin 15 gm. A roentgenogram (Fig. 2) on April 2, at three months of age, shows a large right heart and bilateral upper lobe infiltration, more marked on the right. The child died April 24, 1951.

Autopsy showed transposition of the great vessels, a dilated pulmonary artery one and a half times the size of the aorta, sending a large branch directly to the right and left upper lobes. The right ventricle was greatly hypertrophied, the foramen ovale was

[1] Accepted for publication in April 1953.

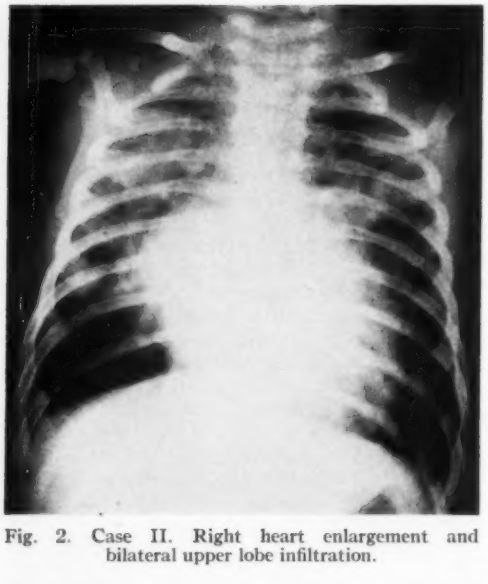


Fig. 2. Case II. Right heart enlargement and bilateral upper lobe infiltration.

closed, a small patent ductus arteriosus and a 1.0 cm. high interventricular septal defect were present. There was no atelectasis or pneumonitis. The infiltration was due to upper lobe hypervascularization.

Case III: C. J., born Aug. 2, 1950, became cyanotic the second day. The heart sounds were regular, the rhythm was normal, and no murmurs were heard. A roentgenogram obtained Aug. 24, at twenty-two days of age (Fig. 3), shows a large right heart and punctate perihilar vascular engorgement extending to the right upper lobe. The child improved in oxygen and was discharged Sept. 3. On Oct. 16 she was admitted for cyanosis and apnea. The red cell count was 6,140,000, the hemoglobin 18.2 gm. A roentgenogram taken on Oct. 16, at ten weeks of age (Fig. 4), shows increased cardiac enlargement, especially on the right, with extensive vascular engorgement, particularly in the right upper lobe. Death occurred Nov. 15, 1950.

Autopsy showed transposition of the great vessels, the dilated pulmonary artery being of equal size with the aorta. The right ventricle was greatly hypertrophied. A patent 5-mm. interventricular septal defect was present, the ductus arteriosus was widely patent, the foramen ovale closed. There was no atelectasis or pneumonitis.

Case IV: P. M. was admitted July 8, 1951, at the age of four months, with cough, dyspnea and cyanosis. Up to this time the child had appeared normal. The heart rate was 130 and the rhythm regular. A systolic murmur was heard at the apex. The clinical impression was viral pneumonitis, cachexia, and mongolism. The red count was 3,730,000, the hemoglobin 11.1 gm. Roentgenography on July 9 (Fig. 5) disclosed a prominent, elevated left apex and a prominent right heart border. There was decreased aeration in the right upper lobe, suggesting atelectasis, and a lesser infiltration in the left upper lobe. Re-examination four days later showed increased prominence of both cardiac borders and a more discrete punctate appearance of the infiltration in both upper lobes, consistent with vascular engorgement. Subsequent examinations (Figs. 6 and 7) showed progressive cardiac enlargement with a constant but variable infiltration in both upper lobes, at times resembling atelectasis. The child was discharged improved July 18 but was re-admitted Sept. 19 and again Dec. 4 for intermittent cyanosis. Tempera-

Figs. 3 and 4. Case III. Roentgenograms obtained at twenty-two days (Fig. 3) and ten weeks (Fig. 4) of age. Enlarged right heart and vascular engorgement.

ture on the last admission was 104°. There were râles, a large liver, but no murmurs. The red cell count was 3,870,000, the hemoglobin 10.7 gm. Death occurred on Dec. 16, 1951.

Autopsy showed a 3-cm. interventricular septal defect immediately below the aortic valve, a hypertrophied right ventricle, a small patent ductus arteriosus, and a dilated pulmonary artery measuring 4 cm. as compared with a 3 cm. aorta. There was no atelectasis or pneumonitis. Pulmonary edema was present.

Case V: E. G., born Oct. 14, 1951, with no apparent abnormality, was admitted Jan. 7, 1952, with shallow respirations, pulse 150, and cyanosis but no murmurs. The red cell count was 4,350,000, the hemoglobin 12.2 gm. The clinical impression was bronchopneumonia, congenital heart disease, mongolism. An electrocardiogram showed an auricular rate of 180, a ventricular rate of 180, a P-R interval of 0.11 and a QRS interval of 0.95. No axis deviation was reported. The interpretation was "usual pattern of infancy except for inverted QRS_3 consistent with congenital heart disease." A roentgenogram obtained Jan. 9, 1952, at eleven weeks of age

Fig. 5. Case IV. Roentgenogram of July 9, 1951, showing elevated left apex, prominent right heart border, and decreased aeration of right upper lobe.

Figs. 6 and 7. Case IV. Later roentgenograms showing progressive cardiac enlargement and infiltration of both upper lobes.

(Fig. 8) shows a large heart and infiltration in the right lung, most marked in the upper lobe, where it simulates atelectasis. Death occurred Jan. 18, 1952.

Autopsy showed a large high interventricular septal defect measuring 2.5 × 2.5 cm.; a patent interatrial septal defect measuring 2.5 × 1.5 cm.; a dilated and hypertrophied right ventricle; a dilated pulmonary artery 3 cm. in diameter as compared with a 2-cm. aorta; a widely patent ductus arteriosus; a small left atrium and ventricle with no communication between the two. There was no atelectasis or pneumonitis. Pulmonary congestion was present.

Case VI: B. Y. was born June 6, 1951, weighing 3.5 pounds, with murmurs but no cyanosis, and was discharged six weeks later weighing 5.5 pounds and in fair condition. At five months of age, the child was admitted with a rapid heart, pallor, and murmurs. Cyanosis appeared later. A roentgenogram obtained Nov. 6, 1951 (Fig. 9), shows a prominent left heart and apex and hypervascularization of the right upper lobe. A second film, Nov. 17, showed no change in the heart but increased consolidation in the right upper lobe, simulating atelectasis.

The child was transferred to St. Michael's Hospital, Newark, N. J., for definitive studies. Fluoros-

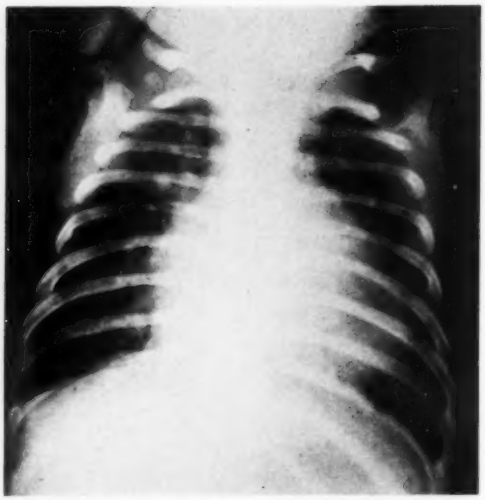
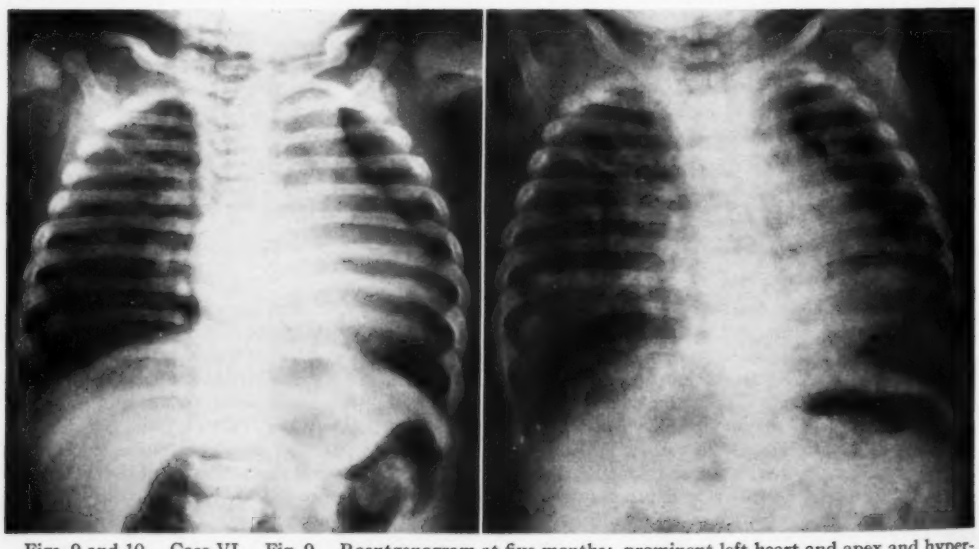


Fig. 8. Case V. Roentgenogram at eleven weeks, showing a large heart and infiltration in right lung.

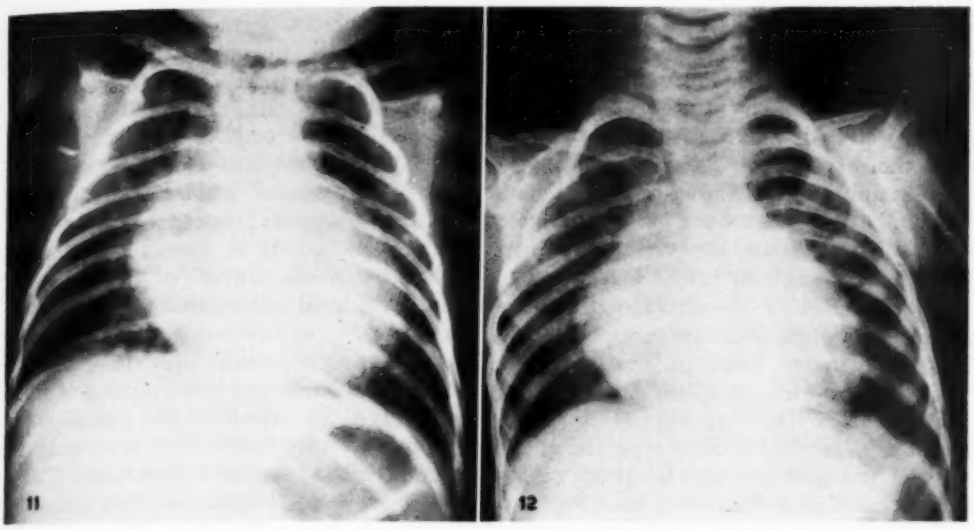
copy there showed "pulmonary segmental atelectasis of the right lower lobe and left lateral lung field, with shifting of the mediastinum to the left on inspiration. There also appeared to be emphysematous changes in both lungs. Bronchoscopy to the carina revealed a good adult type of epiglottis, firm arytenoids, and normal laryngeal motion." Examination of the heart showed "a rough systolic murmur in the third left interspace and a suggestion of a diastolic murmur. *Impression:* Intracardiac shunt, probably interventricular septal defect." Cardiac catheterization and angiography were planned but the patient's condition was never good enough to permit those procedures. A roentgenogram taken Dec. 20, 1951 (Fig. 10), shows a prominent cardiac apex but no gross enlargement. A mottled infiltration is present in both lungs, chiefly in the right upper lobe, suggesting hypervascularization. The child died Jan. 22, 1952.

Autospy at St. Michael's Hospital showed scattered sublobular atelectasis, congestive failure, high large interventricular septal defect, hypertrophy of the right ventricle, large pulmonary artery, marked passive congestion of the liver. The impression was "non-remediable lesion with a tremendous volume of pulmonary blood flow and an intracardiac shunt."

CASE VII: P. W. was born Jan. 13, 1952, with no recorded abnormality. On Jan. 24, 1952, the child showed edema of the hands, feet, and back. The heart and lungs were reported normal, and there was no cyanosis. The red cell count was 5,160,000 and the hemoglobin 17.6 gm. The clinical impression was edema neonatorum and Weber-Christian disease. There was no clinical suspicion of a congenital malformation of the heart. A roentgenogram taken Feb. 8 showed gross cardiac enlargement, chiefly on the right, with generalized hypervascularization. Re-examination on Feb. 14 (Fig. 11) revealed increased pulmonary vascular engorgement. The patient was transferred to St. Michael's Hospital, Newark, N. J., but the condition never improved to the point where definitive studies could be undertaken, and she was sent home. Death occurred Oct. 22, 1952, at home, and the body was brought to the hospital for autopsy. A postmortem roentgeno-



Figs. 9 and 10. Case VI. Fig. 9. Roentgenogram at five months: prominent left heart and apex and hypervascularization of right upper lobe. Fig. 10. Roentgenogram obtained one month later: prominent cardiac apex but no gross enlargement; infiltration in both lungs.



Figs. 11 and 12. Case VII. Fig. 11. Roentgenogram at one month showing cardiac enlargement and pulmonary vascular engorgement. Fig. 12. Postmortem roentgenogram. The heart is enlarged but the lungs show no hypervascularization.

gram (Fig. 12) shows enlargement of the heart, chiefly on the right, but interestingly the lungs show no hypervascularization and appear normally aerated in this unphysiologic state.

Autopsy revealed marked hypertrophy of the right ventricle, producing a bifid apex. The right ventricular wall was 1 cm. thick as compared with 8 mm. for the left ventricle. The foramen ovale was closed; the pulmonary artery was dilated and measured 1.4 cm. in diameter; the aorta measured 1.0 cm. The branches of the pulmonary artery were also dilated. An interventricular septal defect measuring 6 mm. was present high in the membranous portion. The ductus arteriosus was closed. The lungs showed no abnormality.

Case VIII: N. S. was born Dec. 17, 1952, with dusky cyanosis and inability to nurse but improved in oxygen. The condition was too poor, however, for further study. A roentgenogram (Fig. 13) shows massive cardiac enlargement and dilatation of the right pulmonary artery branches. An interventricular septal defect was suspected. The child died the day after birth.

Autopsy showed a large high interventricular septal defect, an atrophic aorta, an interatrial septal defect, a very large pulmonary artery and branches. There was no atelectasis or pneumonitis.

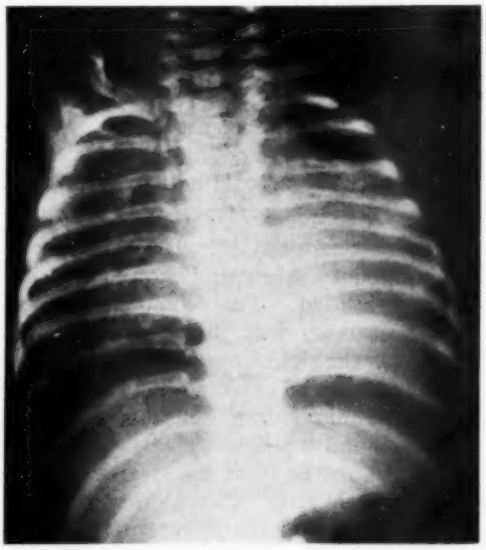


Fig. 13. Case VIII. Massive cardiac enlargement and dilatation of right pulmonary artery branches.

DISCUSSION

The development of surgical procedures for the remedy of congenital malformations of the heart has made necessary the preoperative diagnosis of specific defects. This is difficult in the newborn under the conditions in the hospital of birth. Even should that hospital be a cardiac center, definitive studies would be possible only as the age and condition of the patient permitted. Wittenborg (1) states: "By close cooperation of the cardiologist, radiologist, surgeon

and electrocardiologist we find that a specific diagnosis may usually be made in 85 per cent of cardiac malformations in patients over two years of age. In the remaining cases it may be necessary to call upon more complicated technics, as angiocardiography and cardiovascular catheterization." Such teamwork is not available in most hospitals, and the preliminary diagnosis must be made by simple methods.

The complex of abnormal cardiac size and contour with infiltration, especially in the right upper lobe, in the newborn, strongly suggests certain intracardiac shunts rather than atelectasis or pneumonitis. The first 3 cases reported above showed transposition of the great vessels and an associated shunt that made life possible up to four months. Pulmonary artery hypervascularization was more evident in the right upper lobe, evidently due to direct shunting of a large volume of blood at high tension from the left ventricle through the transposed pulmonary artery.

The last 5 cases presented high interventricular septal defects of varying sizes, with an associated shunt permitting survival up to nine months of age. Radiographically the cardiac apex in these patients tended to be more elevated and pointed than with transposition. In all instances, the pulmonary artery and the right ventricle were dilated. The pulmonary hypervascularization was not so strikingly marked in the right upper lobe in the interventricular septal defects but tended to be more disseminated, if one can generalize from so small a series. The simulation of atelectasis in the right upper lobe may be due to early failure. Case IV demonstrates the variability of the shunt from time to time. Comparison of the postmortem film (Fig. 12) with the antemortem studies in Case VII shows that the infiltration is vascular and dependent on abnormal hemodynamics. Survival to nine months in this case, with an enormously dilated and hypertrophied right ventricle and pulmonary artery, was probably due to the small (6 mm.) interventricular septal defect.

The outcome of these 8 cases, together with the current irremediable status of interventricular septal defects and transposition of the great vessels, would suggest that, once such a diagnosis is probable, it would be as well for the child to remain at or near the local hospital, at least until two years old. Economically and emotionally, this would be a sounder procedure, since cardiac centers are usually at a distance and offer great hope to the parents at much expense and little avail at present. Although the number of cases that have come to autopsy is small, they represent the experience in a small institution, and the attention of other radiologists is called to the points made throughout this paper, that they may be prompted to gather more such data.

Hypervascularization has been described previously but not sufficiently emphasized as a *constant* diagnostic feature in these cases. Thus Taussig (2), in describing transposition of the great vessels, mentions congestion of the lungs as due to cardiac failure, whereas the radiographic picture, as reproduced in her book (Fig. 66, p. 211, and Fig. 69, p. 220), is that of engorged pulmonary vessels. The autopsy reports are incomplete and give only the major finding of transposition. On page 241, Taussig's Case 24 is presented as transposition of the great vessels, but without comment on the striking hypervascularization of the right hilus and upper lobe. Of particular interest is Figure 74, (p. 232). The roentgen report makes no mention of the marked hypervascularization in both upper lobes. The clinical diagnosis was pneumonia and congenital malformation of the heart. Autopsy showed transposition of the large vessels and small septal defects. The lungs showed chronic passive congestion but no consolidation. The comment is made that the erroneous diagnosis of pneumonia was due to congestion of the lungs.

On pages 126–127, Taussig writes: "There is another malformation in which the contour of the heart is similar to a tetralogy of Fallot in that there is no fullness of the pulmonary conus but it differs from a tetralogy of Fallot in that there is adequate circula-

tion to the lungs as evidenced by pulsations in the vascular shadows at the hilus of the lungs. This malformation causes intense cyanosis; nevertheless, there is a relatively high oxygen saturation of the arterial blood and less limitation of activity than occurs with a corresponding degree of cyanosis in a tetralogy of Fallot. The exact nature of this malformation is not known to the author, for although she has seen the clinical syndrome repeatedly, she has not had the opportunity to check the condition at autopsy." In a footnote to this statement she adds: "Since this book went to press, the author has seen one example of this syndrome in which autopsy showed a complete transposition of the great vessels with a small auricular septal defect and a greatly dilated pulmonary artery."

A descriptive handbook on *Congenital Anomalies of the Heart and Great Vessels* (3) presents a case of ventricular septal defect. The roentgenogram (Fig. 35, p. 27) shows a sharply and strikingly demarcated pneumonia-like consolidation in the right upper lobe and a more diffuse infiltration in the left upper lobe (compare with our Case IV, Fig. 6.). The description of Figure 35 mentions only moderate enlargement of the heart, without comment on the lung fields.

On page 43 of this same work, describing an example of transposition of the great vessels (Fig. 55), the writers state that the two-month-old patient was admitted for "pneumonia" (their quotation marks). The report on Figure 55 is globular cardiac enlargement, without mention of the large peripheral pulmonary vessels. Nine such cases are reported; none of the patients lived more than nine months.

An article by Cooley and Sloan (4) reports 13 cases of transposition of the great vessels coming to autopsy. Four of the patients were five to eleven months of age, and 8 fifteen months to seven years. The older children did not show remarkable vascularity of the lungs, indicating a compensatory shunt which prevented overloading of the pulmonary circulation and made life possible up to seven years. Figure 6 A on page 491 of Cooley and Sloan's paper demonstrates preponderant right upper lobe vascularity in a ten-month-old child. At autopsy, the pulmonary artery was larger than the aorta. Their Case 3, Group III (p. 492) is that of a six-year-old child with cyanosis but no murmurs. The conventional film showed "the heart was not definitely enlarged. . .the lung markings were increased in prominence...most noticeable in the right lung." Angiography was inconclusive, and a tetralogy of Fallot was considered to be most likely. The child was explored and at autopsy, four days later, a transposition of the great vessels with a high interventricular septal defect was found. The pulmonary arteries were dilated. The authors' comment on this case was that their experience at that time was limited but "in retrospect it is seen that this case resembles the cases which have just been described" (*i.e.* transposition of the great vessels with interventricular septal defects).

Attention is also called to an article on transposition by Abrams, Kaplan and Purdy (5). Their Figure 1 (Case I) shows only right upper lobe hypervascularization. Figure 3 (Case III), of an older child, shows engorgement of both upper lobes, more pronounced on the right.

SUMMARY

It should be possible for radiologists in small community hospitals to make a presumptive diagnosis of certain inoperable malformations of the heart. Early right upper lobe infiltration with abnormal cardiac size or shape would suggest transposition of the great vessels as a first possibility and interventricular septal defect as a second. The common denominator is a large pulmonary artery. In either case, the lesion is inoperable at present and carries a fatal prognosis, death being due to congestive failure. Digitalis and other supportive measures are indicated. Atelectasis or pneumonitis is overdiagnosed and overtreated in these cases.

The Somerset Hospital
Somerville, N. J.

REFERENCES

1. WITTENBORG, M. H.: Radiological Diagnosis of Congenital Malformations of the Heart and Great Vessels. Refresher Course presented at Thirty-Eighth Annual Meeting of the Radiological Society of North America, Cincinnati, Ohio, December 1952.
2. TAUSSIG, H. B.: Congenital Malformations of the Heart. New York, The Commonwealth Fund, 1947.
3. MAYO CLINIC AUTHORS: Congenital Anomalies of the Heart and Great Vessels. Springfield, Ill., Chas. C Thomas, 1948.
4. COOLEY, R. N., AND SLOAN, R. D.: Angiography in Congenital Heart Disease of Cyanotic Type. III. Observations on Complete Transposition of Great Vessels. Radiology **58:** 481–505, April 1952.
5. ABRAMS, H. L., KAPLAN, H. S., AND PURDY, A.: Diagnosis of Complete Transposition of the Great Vessels. Radiology **57:** 500–513, October 1951.

SUMARIO

Correlación de la Vascularización del Lóbulo Superior del Pulmón con Ciertas Desviaciones Intracardíacas Congénitas

La disnea y la cianosis constituyen casos de urgencia diagnóstica en los recién nacidos. La más frecuente explicación clínica es atelectasia o neumonitis por aspiración, pero según han observado los AA., las desviaciones intracardíacas anómalas representan una causa que no es rara.

Preséntase una serie de 8 casos con hallazgos autópsicos, estudiada desde el punto de vista del radiólogo de un hospital público, a quien le corresponde diferenciar la atelectasia y la neumonitis de las malformaciones cardíacas congénitas y formular un diagnóstico anatómico presuntivo, a menudo a base de las meras radiografías. La infiltración temprana del lóbulo superior derecho con un corazón de tamaño o forma anormales debe sugerir transposición de los grandes vasos como primera e inoclusión del tabique interventricular como segunda posibilidad. El denominador común es una arteria pulmonar hipertrofiada. En ambos casos, la lesión es inoperable hoy día y lleva un pronóstico letal, debiéndose la muerte a insuficiencia congestiva.

Roentgen Aspects of Isolated Valvular Pulmonic Stenosis[1]

S. GILBERT BLOUNT, JR., M.D., MALCOLM C. McCORD, M.D., SEIICHI KOMESU, M.D., and RAYMOND R. LANIER, Ph.D., M.D

ISOLATED valvular pulmonic stenosis is a congenital cardiac anomaly in which the sole abnormality consists of fusion of the leaflets of the pulmonic valve producing a stenotic orifice (Fig. 1). The ventricular septum is intact; the atrial septum may also be intact or there may be a patency of the foramen ovale.

Isolated valvular pulmonic stenosis has been considered of rare occurrence (Taussig, 1; Green, 2). Recent studies (3–13), however, indicate that it must be considered one of the more common congenital anomalies. According to the majority of investigators complex diagnostic studies are necessary for the establishment of a definite diagnosis.

In the past two years 30 patients with this anomaly have been studied at the University of Colorado Medical Center. This number represents approximately 12 per cent of the total patients with congenital heart disease observed during that period. The experience gained by the study of these cases has made it evident that the diagnosis can be established on the basis of the clinical features with a high degree of accuracy, without the aid of elaborate diagnostic procedures such as cardiac catheterization and angiocardiography. The fluoroscopic examination is considered to be of maximum importance. It is the purpose of this paper to emphasize the fluoroscopic and radiographic features that have proved to be of diagnostic value.

Fig. 1. K. W., 5 years. The typical appearance of the pulmonic valve in isolated valvular pulmonic stenosis, as viewed from the pulmonary artery side. The pulmonic valve orifice does not permit the passage of the head of a pin.

ROENTGEN OBSERVATIONS

Cardiac catheterization was performed in 23 of these 30 patients, confirming the diagnosis in each instance. The observations presented at this time are based on the roentgenologic examination of these 23 cases in which a definite diagnosis was established.

Vascularity of Lung Fields: The vascularity of the lung fields was considered to be within normal limits in 9 of the 23 patients (Fig. 2). In the remaining 14 cases it was decreased in varying degree. A marked decrease is illustrated in Figure 3. The evaluation of these patients has altered the current concepts as to the vascular status of the lung fields in pulmonic stenosis. It is now apparent that valvular pulmonic stenosis may exist in the presence of normal vascularity of the lung fields. Decreased vascularity is not an essential feature in the diagnosis.

Main Pulmonary Artery and Proximal Branches: A classic and essential feature of the roentgenologic picture of isolated valvular pulmonic stenosis is prominence

[1] From the Cardiovascular Pulmonary Laboratory of the Department of Medicine and the Department of Radiology, University of Colorado School of Medicine, Denver Colo. This study was supported by a grant (H-241) from the U. S. Public Health Service.

Presented by Raymond R. Lanier, Ph.D, M.D., at the Fourth Inter-American Congress of Radiology, Mexico City, Nov. 2–8, 1952. Accepted for publication in March 1953.

Fig. 2. D. H., 7 years. Proved isolated valvular pulmonic stenosis with normal vascularity of the lung fields.

of the main pulmonary artery. This prominence, which has been termed poststenotic dilatation, is illustrated in Figure 4. It may be obscured in the presence of great hypertrophy and dilatation of the right ventricle (Fig. 5). This latter situation was more frequently encountered in young infants in whom the right ventricle was greatly enlarged. The amplitude of pulsations of the dilated main pulmonary artery segment was increased in all patients.

The size of the right and left pulmonary arteries was within normal limits in 16 of the 23 patients. The vessels were decreased in size in 5 and increased in the remaining 2 patients. The amplitude of pulsations was considered to be decreased in all patients. This association of decreased amplitude of pulsations in the right and left pulmonary arteries and increased amplitude of pulsations in the dilated main pulmonary artery is considered a cardinal feature in the establishment of the diagnosis of isolated valvular pulmonic stenosis.

Heart Size: The size and configuration of the heart showed considerable variation in the 23 patients. The size was normal in 12 patients, and there was enlargement in 11. It is to be emphasized that severe pulmonic stenosis may be present with no increase in heart size. In the 12 patients with hearts of normal size the right ventricular pressures ranged from 41 to 187 mm. Hg, with levels over 100 mm. in 6 patients. Figure 6 shows a cardiac silhouette of normal size; the right ventricular systolic pressure was 142 mm. Hg in this patient. In the child shown in Figure 5, with a greatly enlarged heart, the right ventricular systolic pressure was only 110 mm. Hg. This illustrates the lack of correlation between the magnitude of systolic pressure in the right ventricle and the size of the heart.

Configuration of Right Atrium: The configuration of the cardiac silhouette was of greater importance than heart size. The right atrial shadow was prominent in 11 patients and within normal limits in 12. The finding of a prominent right atrial shadow in the presence of a normal ven-

Fig. 3. K. W., 5 years. Proved isolated valvular pulmonic stenosis with avascular lung fields.

tricular area was considered suggestive of isolated valvular pulmonic stenosis. This feature is demonstrated in Figure 7. The enlarged right atrium assumed a typical configuration in the left anterior oblique position, appearing as a smooth continuous arc (Fig. 8).

Right Ventricular Configuration: The configuration of the ventricular mass was suggestive of right ventricular hypertrophy

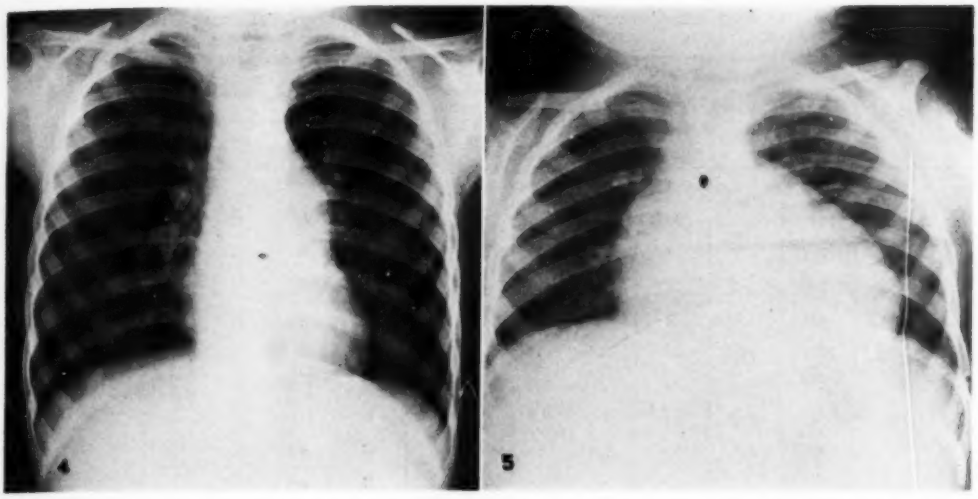


Fig. 4. B. B., 3 years. Post-stenotic dilatation of the main pulmonary artery in isolated valvular pulmonic stenosis.

Fig. 5. E. H., 4 years. Marked dilatation of the right ventricle obscuring the post-stenotic dilatation of the main pulmonary artery in isolated valvular pulmonic stenosis.

in 5 of the 12 patients with a heart of normal size. This configuration (Fig. 9) is characterized by a "snubbing" and uplifting of the apical area. The right anterior oblique view revealed forward enlargement of the heart of varying degrees.

When dilatation of the ventricle had occurred in addition to hypertrophy, the configuration was less distinctive and it was often difficult to differentiate the respective chambers. This was particularly true in infants and young children (Figs. 3 and 5).

The left ventricle and left atrium were within normal limits in all patients. In massive enlargement of the heart, however, the barium-filled esophagus showed a diffuse posterior displacement when viewed in the right anterior oblique position. This was considered to be a manifestation of the overall enlargement of the heart and not an indication of specific left atrial prominence.

Fig. 6. J. K., 8 years. Heart of normal size with high right ventricular pressure in isolated valvular pulmonic stenosis.

DISCUSSION

The majority of congenital cardiac anomalies tend to produce roentgenologic features that assume a distinctive pattern. Thus, in the tetralogy of Fallot, the roentgenologic picture is quite characteristic and relatively uniform from patient to patient. In the entity under discussion, however, wide variation of the roentgenologic pattern is characteristic. At one end of the spectrum the small heart with normal lung vascularity and a prominent post-stenotic dilatation is seen, while at the other extreme there may be a greatly en-

TABLE I: ROENTGENOLOGIC AND CATHETERIZATION FINDINGS IN ISOLATED VALVULAR PULMONIC STENOSIS: ASYMPTOMATIC CASES AND CASES WITH MODERATE AND SEVERE SYMPTOMS

Patient	Age and Sex	Heart Size* %	Vascularity of Lung Fields†	Main Pulmonary Artery‡		Rt. and Lt. Pulmonary Arteries		Heart Chamber Enlargement			Pressure, mm. Hg			Art. O_2 Sat. %
				Size	Act.	Size	Act.	R.A.	R.V.	Left	R.A.	R.V.	Pul. Art.	
Asymptomatic Cases														
1. L. R.	14F	+ 5	N	++	+	N	N	N	N	N	7/4	45/7	25/16	90
2. D. H.	7M	−20	N	++	+	N	N	N	N	N	6/1	47/5	21/11	96
3. C. P.	7F	± 0	N	+	+	N	N	N	N	N	10/8	58/8	21/15	96
4. S. N.	4M	−20	N	++	++	N	N	N	+	N	8/5	63/3	17/13	99
5. J. G.	13M	+10	N	++	++	N	N	++	N	N	8/1	100/3	15/9	95
6. R. H.	7M	− 5	−	+	++	N	−	N	++	N	6/3	105/2	25/12	86
7. D. W.	4F	+ 5	−	++	++	−	−	+++	++	N	13/5	183/1	24/11	95
8. D. N.	4F	± 0	−	++	++	N	−	N	+	N	11/6	221/10	18/11	88
9. B. B.	3F	−10	−	+	+	N	−	N	±	N		46/5	25/18	96
10. H. D.	7M	−20	−	+	++	N	−	+	+	N	6/1	47/5	21/11	96
11. F. F.	13F	+25	−	+	++	N	−	+	+	N	19/1	187/2	21/13	98
12. K. J.	8F	− 5	−	++	++	N	−	N	+	N	10/2	142/1	20/12	95
Cases with Moderate Symptoms														
13. R. McC.	12F	+25	−	++	+	N	−	N	++	N	10/5	95/5	91/10	80
14. R. D.	10M	− 5	−	+	++	N	−	N	+	N	10/4	137/6	23/13	90
15. B. L.	8F	± 0	N	++	+	N	−	N	+	N		138/12		90
16. R. H.	11M		−	+	++	−	−	+	++	N	13/10	144/8	19/12	90
17. R. M.	5M	+40	−	+++	++	N	−	+	+++	N	13/3	176/−1	16/8	78
Cases with Severe Symptoms														
18. K. W.	5M	+97	−	+	++	−	−	+++	+++	N	10			35
19. E. H.	4M	+48	−	++	++	N	−	++	+++	N		110		
20. C. T.	8F	+10	−	+++	++	N	−	++	+++	N	10/3	200	20/17	78

* Hodges and Meyer.
† N. Normal. − Decreased.
‡ Graded N to +++.

larged heart with avascular lung fields and no apparent prominence of the main pulmonary artery.

There is likewise a wide variation of the clinical features, ranging from the noncyanotic, active individual to the deeply cyanotic incapacitated patient. It is of great importance to note that the range of the roentgenologic pattern does not necessarily correlate with the clinical condition of the patient or with the severity of the hemodynamic alterations as determined by cardiac catheterization. In Table I, 20 cases have been grouped according to the severity of symptoms, with concomitant roentgenologic and dynamic features.[2] Examination of these data will reveal lack of correlation between the roentgenologic features and the physiologic studies.

Congenital cardiac anomalies that may present a somewhat similar roentgenologic picture and must be considered in the differential diagnosis are defects giving rise to a left-to-right shunt with an enlarged pulmonary artery. Atrial or ventricular septal defects and patent ductus arteriosus are the common anomalies comprising this

[2] Three additional cases were included in this report after completion of the table.

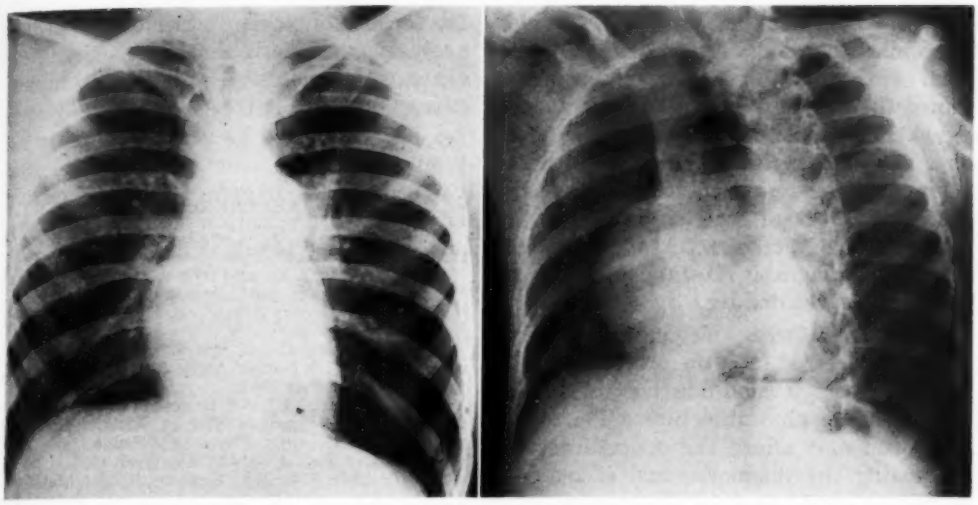


Fig. 7 (left). J. G., 13 years. Heart of normal size with prominent right atrium in isolated valvular pulmonic stenosis.

Fig. 8 (right). D. W., 4 years. The enlarged right atrium in the left anterior oblique position in isolated valvular pulmonic stenosis.

group. Fluoroscopic examination in most instances presents a distinguishing pattern. The vascularity of the lung fields is usually increased and the right and left pulmonary arteries are enlarged in keeping with the prominent main pulmonary artery. The most important distinction, however, is the equal amplitude of pulsations in the right and left pulmonary arteries and in the main pulmonary artery.

A more difficult differential problem is presented by those entities characterized by pulmonary hypertension without an increased pulmonary flow, notably Eisenmenger's complex, idiopathic pulmonary hypertension, and the rare patent ductus arteriosus with reversed blood flow. In these conditions the configuration of the right heart and main pulmonary arteries and the peripheral vascularity of the lungs may be similar to the findings in isolated valvular pulmonic stenosis. The size and pulsations of the right and left pulmonary arteries may offer some aid in differential diagnosis. The right and left pulmonary arteries are usually increased in size in these diseases. The amplitude of pulsations is normal or increased but always corresponds to the amplitude in the main pulmonary artery. Another difficult differential problem is presented by the rare tetralogy of Fallot with pulmonic stenosis at the valvular level, which may result in a prominent post-stenotic dilatation of the main pulmonary artery. It is virtually impossible to make this diagnosis without the aid of more complex procedures.

Fig. 9. R. H., 7 years. Right ventricular hypertrophy in isolated valvular pulmonic stenosis.

The recognition of isolated valvular pulmonic stenosis by the radiologist is of vital importance, as this anomaly has joined the patent ductus arteriosus, tetralogy of Fallot, and coarctation of the aorta as a lesion that is amenable to surgical therapy. The nature of this defect permits adequate surgical correction to restore the patient to a relatively normal state if the diagnosis is established early in the course of the disease.

The patient with this anomaly is frequently referred to the radiologist as having a benign condition because of the asymptomatic clinical picture. The roentgenogram may afford the opportunity for suggesting the diagnosis, and it may be definitely established by fluoroscopy in a high percentage of patients.

The normal heart size in many of these patients should not lull the radiologist into a feeling of security once the diagnosis has been established. Further studies are indicated in all patients in order to establish the severity of the stenosis. These patients notoriously do well until the onset of right ventricular failure, at which time they deteriorate rapidly. Thus, if significant elevation of the systolic pressure of the right ventricle is present, surgical correction is indicated despite a normal heart size and lack of symptoms.

SUMMARY

The roentgenologic features of 23 cases of isolated valvular pulmonic stenosis are presented and the wide variation in the roentgen characteristics is illustrated. Diagnosis of this congenital cardiac anomaly can be established in a large percentage of patients by radiologic examination.

4200 East Ninth Ave.
Denver 20, Colo.

REFERENCES

1. TAUSSIG, H. B.: Congenital Malformations of the Heart. New York, Commonwealth Fund, 1947.
2. GREENE, D. E., AND OTHERS: Pure Congenital Pulmonary Stenosis and Idiopathic Congenital Dilation of the Pulmonary Artery. Am. J. Med. **6:** 24–40, January 1949.
3. ABRAHAMS, D. G., AND WOOD, P. H.: Pulmonary Stenosis with Normal Aortic Root. Brit. Heart J. **13:** 519–548, October 1951.
4. ADAMS, F. H., AND OTHERS: Congenital Valvular Pulmonary Stenosis With or Without an Interatrial Communication: Physiologic Studies as Diagnostic Aids. J. Pediat. **38:** 431–441, April 1951.
5. BLOUNT, S. G., JR., KOMESU, S., AND MCCORD, M. C.: Asymptomatic Isolated Valvular Pulmonary Stenosis. New England J. Med. **248:** 5–11, Jan. 1, 1953.
6. BROCK, R. C.: Congenital Pulmonary Stenosis. Am. J. Med. **12:** 706–719, June 1952.
7. CAMPBELL, M., AND HILLS, T. H.: Angiocardiography in Cyanotic Congenital Heart Disease. Brit. Heart J. **12:** 65–95, January 1950.
8. DOW, J. W., AND OTHERS: Studies of Congenital Heart Disease. Uncomplicated Pulmonic Stenosis. Circulation. **1:** 267–287, February 1950.
9. ENGLE, M. A., AND TAUSSIG, H. B.: Valvular Pulmonic Stenosis with Intact Ventricular Septum and Patent Foramen Ovale. Report of Illustrative Cases and Analysis of Clinical Syndroms. Circulation **2:** 481–493, October 1950.
10. GØTZSCHE, H., ESKILDSEN, P., AND HANSEN, A. T.: Isolated Pulmonary Stenosis. Acta med. Scand. **139:** 431–444, 1951.
11. LARSSON, Y., AND OTHERS: Congenital Pulmonary Stenosis without Overriding Aorta. Clinical Study. Am. Heart J. **42:** 70–80, July 1951.
12. MARAIST, F., AND OTHERS: Physiological Studies in Congenital Heart Disease; the Physiological Findings in 34 Patients with Isolated Pulmonary Valvular Stenosis. Bull. Johns Hopkins Hosp. **88:** 1–19, January 1951.
13. POLLACK, A. A., TAYLOR, B. E., ODEL, H. M., AND BURCHELL, H. B.: Symposium on Cardiac Catheterization; Pulmonary Stenosis without Septal Defect. Proc. Staff Meet., Mayo Clin. **23:** 516–520, Oct. 27, 1948.

SUMARIO

Aspectos Roentgenológicos de la Estenosis Aislada de la Válvula Pulmonar

Aunque varían considerablemente las características radiológicas de la estenosis aislada de la válvula pulmonar, cabe establecer el diagnóstico con bastante certidumbre por medio de la roentgenografía y la roentgenoscopia sin echar mano a los procedimientos más complicados de diagnóstico. Las observaciones aquí presentadas se basan en 23 casos, en los que se hizo el diagnóstico radiológicamente y se confirmó más adelante con el cateterismo cardíaco.

Una característica clásica y esencial del cuadro roentgenológico consiste en la

prominencia de la principal arteria pulmonar, aunque pueden eclipsarla la hipertrofia o la dilatación del ventrículo derecho. La amplitud de las pulsaciones de la arteria aumenta en contraposición a lo que sucede en las ramas derecha e izquierda, en las que disminuye. El corazón tal vez tenga tamaño normal y la vascularidad de los campos pulmonares quizás no exceda los límites normales. Una imagen prominente de la aurícula derecha acompañada de una zona ventricular normal es indicativa del diagnóstico.

El patrón roentgenológico no revela mayor correlación con el estado clínico del enfermo o con la gravedad de las alteraciones hemodinámicas, según las determina el cateterismo cardíaco.

Radiologic Detection of a Calcified Thrombus Within the Left Ventricle

Report of a Case with Surgical Verification[1]

J. STAUFFER LEHMAN, M.D., and JOSEPH L. CURRY, M.D.

ROENTGEN criteria for the recognition and localization of cardiac calcification have been well established (1, 2). Detection of calcific deposits within the annulus fibrosus, valves, coronary arteries, myocardium, and pericardium has frequently been described. Radiologic antemortem observation of left atrial calcification, however, was rarely reported until recent years (3, 4, 5). Roentgen diagnosis of a calcified thrombus within the left ventricle is a rarity. The following case report emphasizes the importance of careful fluoroscopy in the recognition of this condition.

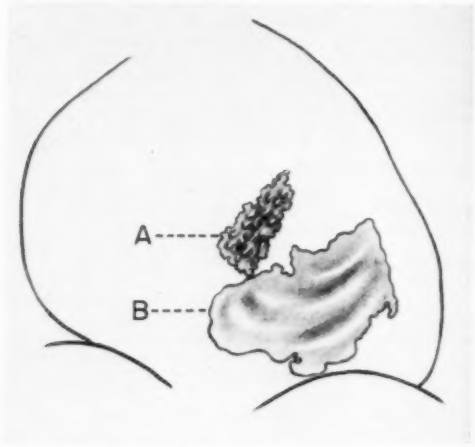


Fig. 1. Intracardiac calcifications, with diagrammatic tracing, postero-anterior projection. A. Mitral valve calcification. B. Calcified left ventricular thrombus.

CASE REPORT

A 41-year-old female was hospitalized in October 1952 for the surgical relief of mitral stenosis. Preoperative fluoroscopic examination presented immediate and obvious evidence of two well defined calcium masses within the cardiac silhouette (Figs. 1 and 2). On careful observation it was noted that these two calcific "islands" displayed independent motion, approaching each other during ventricular systole and separating during diastole (Fig. 3). A normal sinus rhythm was present, with a cardiac rate of 70/min., so that motion of the calcifications could be correlated with pulse and heart sounds.

The uppermost calcific mass displayed typical elliptical oscillatory motions, and its location left little doubt that it represented plaque-like calcification of the mitral valve. The large "island" of calcium in the lowermost portion of the cardiac silhouette was deeply located within the heart in all angles of rotation. Moreover, this mass was clearly situated within the territory of the left ventricle and assumed considerable dimensions in all observed positions. For these reasons, a preoperative diagnosis of calcified left ventricular thrombus was made in a case of mitral stenosis.

At surgery, the pericardium was found to be nonadherent, and a large, mound-like elevation could be seen and felt over the posterior portion of the left ventricle, where contraction was limited. The overlying myocardium was not grossly discolored. Digital exploration through the left atrial appendage revealed extensive calcification of a stenotic mitral valve, markedly involving the septal leaflet. Following commissurotomy, the exploring intra-

[1] From The Department of Radiology, The Hahnemann Medical College and Hospital, Philadelphia, Penna. Accepted for publication in March 1953.

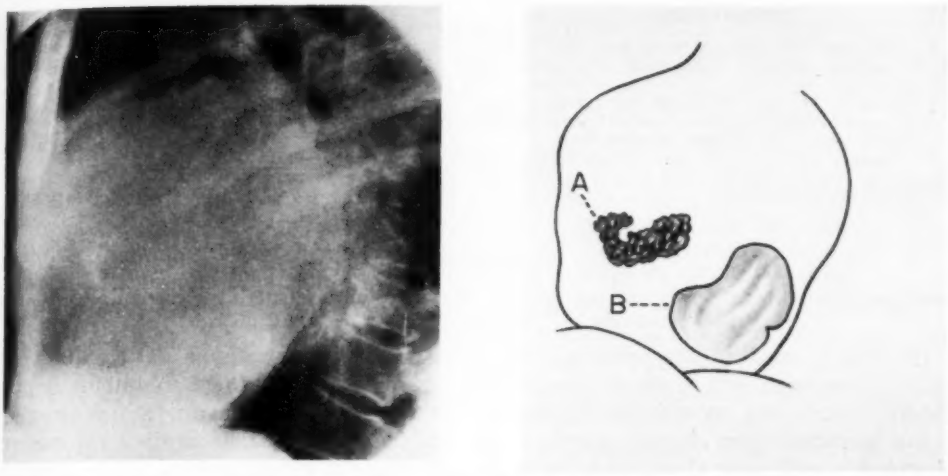


Fig. 2. Intracardiac calcifications, with diagrammatic tracing, lateral projection. A. Mitral valve calcification. B. Calcified left ventricular thrombus.

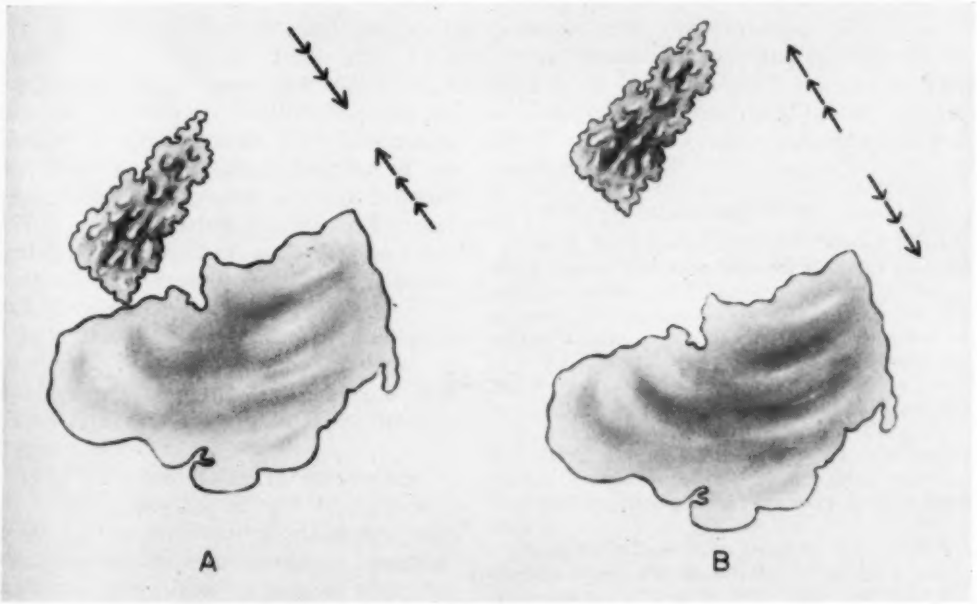


Fig. 3. Schematic diagram illustrating positional change of intracardiac calcification during (A) left ventricular systole and (B) left ventricular diastole.

atrial finger was passed into the left ventricle, where the posterior chordae tendinae seemed to be enmeshed in a firm mass consistent with thrombus.

SUMMARY

Radiologic diagnosis of an unusual case of calcified thrombus within the left ventricle is reported. Recognition of a deep location of the thrombus within the territory of the left ventricle and changes in its position induced by ventricular motion are stressed as important features in the diagnosis.

REFERENCES

1. ROESLER, H.: Clinical Roentgenology of the Cardiovascular System. Springfield, Ill., Chas. C Thomas, 1943.
2. SOSMAN, M. C.: Technique for Locating and Identifying Pericardial and Intracardiac Calcifications. Am. J. Roentgenol. **50:** 461–468, October 1943.
3. EPSTEIN, B. S.: Left Atrial Calcification in Rheumatic Heart Disease. Am. J. Roentgenol. **61:** 202–208, February 1949.
4. YOUNG, D., AND SCHWEDEL, J. B.: Calcification of the Left Atrium in Rheumatic Heart Disease. Am. Heart J. **40:** 771–778, November 1950.
5. CURRY, J. L., LEHMAN, J. S., AND SCHMIDT, E. C. H.: Left Atrial Calcification. Report of Eight Cases Verified at Surgery for the Relief of Mitral Stenosis. Radiology **60:** 559–563, April 1953.

Hahnemann Hospital
230 N. Broad St.
Philadelphia 2, Penna.

SUMARIO

Descubrimiento Radiológico de un Trombo Calcificado dentro del Ventrículo Izquierdo. Presentación de un Caso con Comprobación Quirúrgica

Descríbese aquí el diagnóstico radiológico de un caso extraño de trombo calcificado dentro del ventrículo izquierdo. Como características importantes en el diagnóstico recálcanse el reconocimiento de la localización profunda del trombo en la región del ventrículo y los cambios de posición debidos al movimiento ventricular. Había además calcificación en forma de placas de la válvula mitral.

Kartagener's Triad

Report of Two Cases[1]

T. A. GROSS, M.D.[2]

KARTAGENER'S syndrome, a triad consisting of situs inversus with bronchiectasis and paranasal sinusitis, has been fully described by Adams and Churchill (1), and more recently by Zuckerman and Wurtzebach (7), who found that 40 cases had been reported up to 1950. Since then a case has been added by Cohen, Goldstein, and Hamill (3).

The concomitance of situs inversus and bronchiectasis was first noted in 1904 by Siewert (6), who described a case of situs inversus in a twenty-year-old male with a productive cough since birth. A second case was reported in 1909, and another in 1923. Kartagener, in 1933 and 1935, reported 11 more cases and called attention to the added presence of paranasal sinusitis in these patients. Strictly speaking, however, this third member of the triad need not be present since, as is generally known, sinusitis occurs in approximately 90 per cent of cases of bronchiectasis, the two conditions having a causal and sequential relationship.

It is the purpose of the present communication to report the incidence of Kartagener's triad at the State of Wisconsin General Hospital and to describe 2 recent cases.

That the simultaneous occurrence of these abnormalities is not fortuitous is borne out by the disproportionately high incidence of bronchiectasis in patients with situs inversus as compared with that in the total number of hospital admissions. At the Massachusetts General Hospital, from 1866 to 1937 (1) the incidence of bronchiectasis was but 0.3 per cent in 232,112 admissions. During the same period, among 23 patients with situs inversus there were 5 cases of bronchiectasis and chronic sinusitis, an incidence of 21.7 per cent. At the Mayo Clinic from 1920 to 1941 (4) there were 85 cases of situs inversus, with bronchiectasis in 14, an incidence of 16.5 per cent, as contrasted to 0.5 per cent among all patients registered at the Clinic. At the State of Wisconsin General Hospital among some 262,000 admissions from 1922 to 1952, there are records of 13 cases of complete transposition of viscera. In addition, 1 case of Kartagener's syndrome was found among out-patients. Of the 13 hospital patients with situs inversus, 3 had associated bronchiectasis and paranasal sinusitis, an incidence of 23 per cent. Two of these cases are described below. In the third a bronchographic examination was not done.

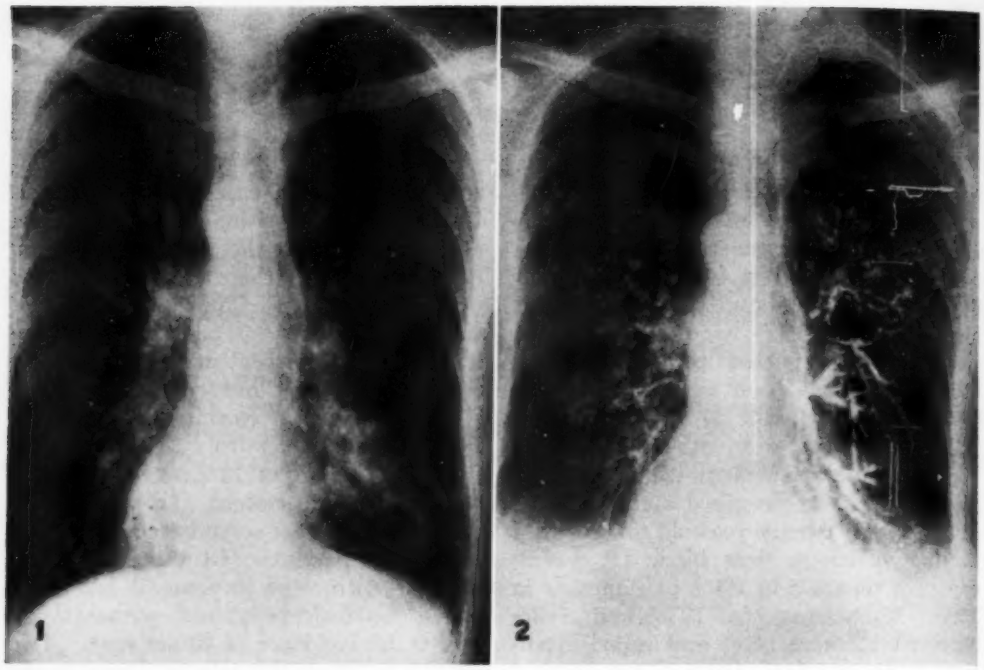
CASE REPORTS

CASE I: P. S., a white male of 67, was admitted to the State of Wisconsin General Hospital in April 1952, complaining of bronchitis. Although the time of onset of symptoms is not definitely known, the patient appears to have had a productive cough most of his adult life. In the past ten years his symptoms had become progressively more severe and paranasal sinusitis and dyspnea had developed. The past history, except for symptoms relative to the present complaint, was non-contributory. Physical examination showed reddening of the nasal mucosa; otherwise the physical and laboratory findings were normal.

Roentgen Findings (Figs. 1 and 2): The roentgenologist's report was as follows: "The chest is emphysematous, with a deepened anteroposterior diameter. There is complete situs inversus, with the heart a mirror image of the normal and the gastric air bubble beneath the right dome of the diaphragm. In addition to the emphysema, there is extensive linear and patchy increase in density in both lung bases, more pronounced on the left. Here there is a good deal of fibrosis in addition to the linear shad-

[1] From the Department of Radiology, University of Wisconsin, and the State of Wisconsin General Hospital, Madison, Wisc. Presented in part before the Wisconsin Radiological Society, May 1952. Accepted for publication in March 1953.

[2] Now at Vanderbilt University, Nashville, Tenn.



Figs. 1 and 2. Case I.

ows. There are small calcific foci scattered in the lower lobes and there are apical scars.

"Sinuses: There is extensive chronic disease with practically complete opacity of the sinuses and with a good deal of sclerotic reaction in their bony walls.

"Bronchograms: The lobar configuration on the two sides is reversed. On the right side there are beading and irregular constriction and dilatation of the bronchi and their segmental divisions in the lingula and the lower lobe. In the upper lobe the changes are those of emphysema. On the left side there is irregular dilatation of the anterolateral apical segmental bronchi of the upper lobe, as well as gross dilatation of all the major bronchi of the lower lobe.

"Conclusions: Situs inversus. Severe dendritic bronchiectasis involving both lower lobes, the lingula of the right upper, the anterolateral of the left apical, and probably the left middle. Severe emphysema. Chronic pansinusitis."

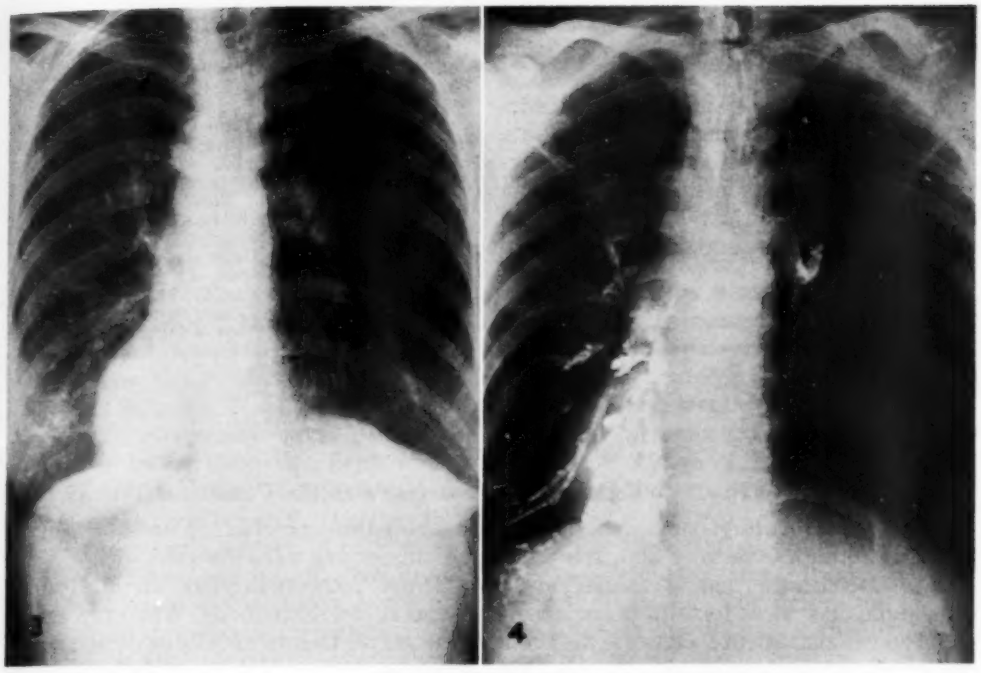
CASE II: M. L., a white female of 38, was admitted to the tuberculosis service of the State of Wisconsin General Hospital in November 1948, with a long standing history of pulmonary tuberculosis and bronchiectasis. She had had several admissions to one of the State sanatoria, the first in 1941, and there had been several previous admissions to this hospital for unrelated conditions. In 1950 she had pneumonia, and her last admission was in March 1952. On physical examination the significant positive findings were limited to the chest. There were scattered areas of decreased tactile fremitus, inspiratory vesicular râles, and bronchial breath sounds. The heart was percussed to the right of the mid-line.

Roentgen Findings (Figs. 3 and 4). In 1948 the report on the chest was as follows: "There is complete transposition of the viscera, the heart being on the right and a mirror image of the normal, and the stomach under the right diaphragm. There is fibroid infiltration throughout the right apical and subclavicular regions."

In 1952 the roentgenologist found the tuberculous disease in the right apex unchanged, "but considerable change has taken place in the bases, particularly on the right, where there is a good deal of stringy density extending down to the medial base behind the heart as well as toward the parietes. There are small oval radiolucencies behind the heart, and there are similar but less extensive changes on the left.

"Right bronchogram: In the lower lobe the bronchi and their segmental divisions are grossly dilated, with terminal sacculation. These bronchi are closely grouped as a result of atelectatic changes. In the upper lobe the lingular branches are normal in appearance. The terminal branches of the upper lobe bronchus are incompletely filled. There is retraction of the right main stem bronchus upward, secondary to fibrotic changes.

"Sinuses: There is a rounded soft tissue density



Figs. 3 and 4. Case II.

in the right maxillary antrum, most likely a retention cyst. The remaining sinuses are clear.

"Conclusions: Situs inversus. Fibroid tuberculosis of the upper lobe on the right. Tubular and saccular bronchiectasis in both lower lobes. Retention cyst of right maxillary antrum."

DISCUSSION

The frequency with which bronchiectasis and sinusitis occur in situs inversus may be of more than statistical interest. Proponents of a congenital etiological basis for bronchiectasis point out that, with the relatively high incidence of this association, mere coincidence is not likely, and they postulate that the same congenital factors which operate to produce situs inversus may also be instrumental in bringing about bronchiectasis. Thus, Kartagener (2), Sauerbruch (5), and others believe that 80 per cent of the cases of bronchiectasis occurring in childhood are on a congenital basis, due to maldevelopment. In the Mayo Clinic series half the patients gave a history of bronchiectatic symptoms for as long as they could remember.

On the other hand, review of the literature indicates that, while a large number of patients with this syndrome have had symptoms dating to infancy, in a substantial percentage evidence of bronchiectasis did not appear until later childhood or adulthood, with the ages ranging to sixty-seven years; not infrequently the symptoms followed respiratory infections, as pertussis, pneumonia, and tuberculosis. It is not within the province of this report to investigate the merits of the theories relative to the origin of bronchiectasis. Certainly, the concurrence of the findings in Kartagener's syndrome is well established.

Although it is true that in the reported series the number of cases is relatively small and that failure to include an unrecognized case of situs inversus would decrease the incidence considerably, the difference between the frequency of bronchiectasis in situs inversus and in the general hospital population is sufficiently large to be significant.

SUMMARY

1. The incidence of Kartagener's triad is briefly reviewed.

2. Two additional cases are described.

3. Although there has been no adequate explanation for the presence of bronchiectasis and paranasal sinusitis in association with situs inversus, the relatively frequent concurrence of these findings is well established.

REFERENCES

1. ADAMS, R., AND CHURCHILL, E. D.: Situs Inversus, Sinusitis, Bronchiectasis. J. Thoracic Surg. **7**: 206–217, December 1937.

2. ADLAND, S. A., AND EINSTEIN, R. A. J.: Kartagener's Triad; Situs Inversus Viscerum, Bronchiectasis and Paranasal Sinusitis. Am. J. Dis. Child. **61**: 1034–1036, May 1941.

3. COHEN, S., GOLDSTEIN, J. D., AND HAMILL, J.: Kartagener Syndrome. J. M. Soc. New Jersey **47**: 557–560, December 1950.

4. RICHARDS, W. F.: Situs Inversus Viscerum, Absent Frontal Sinuses with Ethmoid and Maxillary Infection and Bronchiectasis. Tubercle **25**: 27–29, March-April 1944.

5. ROSENTHAL, D. B.: Bronchiectasis and Visceral Transposition, with Report of a Case. M. J. Australia **1**: 761–764, May 20, 1939.

6. SIEWERT, A. K.: Ueber einen Fall von Bronchiectasie bei einem Patientem mit Situs Inversus Viscerum. Berl. klin. Wchnschr. **41**: 139–141, 1904.

7. ZUCKERMAN, H. S., AND WURTZEBACH, L. R.: Kartagener's Triad. Review of Literature and Report of a Case. Dis. of Chest **19**: 92–97, January 1951.

Hotel Dieu Hospital
New Orleans, La.

SUMARIO

Triada de Kartagener: Presentación de Dos Casos

La triada de Kartagener consta de situs inversus, bronquiectasia y sinusitis paranasal. Demuestra que la asociación de esas anomalías no es fortuita la incidencia desproporcionadamente elevada de bronquiectasia en enfermos que tienen situs inversus según han comunicado varios observadores. Ocurre sinusitis aproximadamente en 90 por ciento de todos los casos de bronquiectasia, y ambas pasan por reconocer una relación etiológica.

Entre 262,000 ingresos en el Hospital General del Estado de Wisconsin en un período de treinta años, descubriéronse 13 casos de transposición total de las vísceras. Tres de esos enfermos, o sea 23 por ciento, tenían ademas bronquiectasia y sinusitis. Descríbense 2 de esos casos.

Gastro-Oesophageal Incompetence in Children

With Special Reference to Minor Degrees of Partial Thoracic Stomach[1]

ROY ASTLEY, M.B., D.M.R., and IVO J. CARRÉ, M.R.C.P., D.C.H.

IT IS BECOMING recognised that weakness of the valve mechanism between oesophagus and stomach is a not infrequent cause of vomiting in infancy and early childhood (1, 2). This gastro-oesophageal incompetence allows abnormal reflux of stomach contents into the gullet, a process facilitated by the horizontal posture and fluid diet of infancy.

In 1947, Neuhauser and Berenberg described in babies the condition of cardio-oesophageal relaxation or "chalasia," in which the cardia is normally situated but wide and patulous, permitting easy reflux (3–5). More frequent than this condition, in our experience with children, is the so-called "short oesophagus," with a small proportion of the stomach situated above the diaphragm.

At The Children's Hospital in Birmingham (England), the annual incidence of hypertrophic pyloric stenosis is about 90 cases. In one year we see about 18 infants under twelve months of age, as well as a number in the older age groups, in whom vomiting is associated with a minor degree of partial thoracic stomach. Thus the condition is of considerable importance. The present paper is based on a study of 115 cases.

PATHOLOGY

The normal valve mechanism between the oesophagus and the stomach may be considered as a triple entity (6–10). One component is the "pinchcock" of the muscular right crus of the diaphragm, which largely constitutes the oesophageal hiatus. Possibly more important is the normal obliquity of insertion of the oesophagus into the stomach. This angle is maintained by the oblique fibres of the stomach wall, looped around the cardiac incisura, and by the sling-like action of the right crus, an action which Allison (10) compares to that of the pubo-rectalis muscle in controlling defaecation. The third and perhaps weakest element is the sphincteric action inherent in the lower end of the oesophagus itself; although there is no anatomical sphincter to be detected here, there is evidence that a functional sphincter exists.

In the condition of "short oesophagus" and partial thoracic stomach, the oesophagus has a normal direct course but terminates above the diaphragm by entering the apex of a small loculus of the thoracic stomach. The proportion of the stomach that lies above the diaphragm is variable; in all of the present series of cases it has been estimated at under 15 per cent and often very much less. (More gross herniations are relatively uncommon; they are less apt to produce symptoms due to gastro-oesophageal incompetence and may conceivably have a different aetiology.) The diaphragmatic hiatus is wider than usual and, as a result, the "pinchcock" action of the right crus is less effective than in the normal individual. Moreover, the direct entry of the oesophagus into the apex of the thoracic stomach means that the second valvular element, the obliquity of insertion, is lost. Only the weak sphincteric action of the oesophagus remains (Fig. 1).

The repeated presence of regurgitated contents in the oesophagus usually causes oesophagitis, with inflammatory oedema and superficial erosion of the wall. In a few children this progresses to deep ulceration and an oesophageal stricture, in which fibrosis plays its part, although swelling and spasm are often important components. Such narrowing, secondary to reflux

[1] From The Children's Hospital, Birmingham, England. Accepted for publication in January 1953.

oesophagitis, probably accounts for many of the so-called "congenital strictures" of the oesophagus (11, 12). Moreover, it explains the association of a "congenital stricture" with a "short oesophagus" that has been recognised in past years(13–15).

In the literature since 1930 there are just over 100 cases of "short oesophagus" and partial thoracic stomach described in children under twelve years of age. Of these, no less than 60 were associated with an oesophageal stricture; thus the impression gained from the literature is that this serious complication is of frequent occurrence. However, it has been our experience that probably less than one-tenth of all children with a minor degree of partial thoracic stomach do in fact develop oesophageal narrowing (16).

There are varying views concerning the origin of the "short oesophagus"; these have been well reviewed by Smithers (17), and we do not propose to discuss them at length. It was originally considered that there was a failure of longitudinal development of the oesophagus (7, 13–15). A strong body of opinion (18–21) now favours a primary diaphragmatic deficiency with secondary gastric herniation and subsequent fixation by fibrosis due to oesophagitis. It is to be pointed out that this view is largely founded on experience with the adult. In children, a hiatal deficiency is undoubtedly primary in many of the larger hernias. However, in the group of children with which we are here concerned, there is only a small and often tubular loculus of stomach above the diaphragm. We believe that in this group it is still unknown how many are primarily hiatal defects and how many are true examples of the congenital short oesophagus.

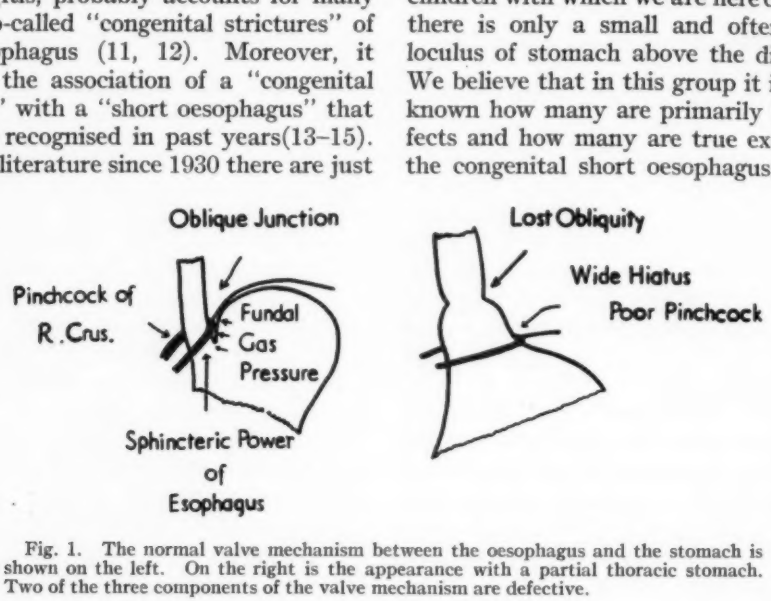


Fig. 1. The normal valve mechanism between the oesophagus and the stomach is shown on the left. On the right is the appearance with a partial thoracic stomach. Two of the three components of the valve mechanism are defective.

CLINICAL FEATURES

Vomiting is the outstanding symptom, in the majority of cases, beginning shortly after birth or in the neonatal period. In a small minority, however, it begins with the introduction of solids into the diet, and we have seen one child whose symptoms did not commence until the age of ten years. Characteristically, vomiting occurs immediately after feeding; occasionally it seems to result from laying the baby down in its cot. A relationship to sleeping flat at night or coughing may become a feature as the child grows older. During the first few weeks of life, the vomiting may have the same projectile quality as seen in hypertrophic pyloric stenosis, although this feature diminishes in later infancy.

Blood is commonly present in the vomitus from time to time, more especially during infancy. The blood is usually altered in character and is present in small amounts only. We have not personally observed any instances of large haematemeses, although such cases have been recorded.

Mucus occurs in the vomitus, often in large quantities.

Feedings are taken hungrily.

Dysphagia for solid food is the predominant and characteristic symptom when there is a complicating oesophageal stricture. It may also occur, however, in the absence of stricture formation and in these instances is presumably secondary to oesophagitis with oedema and spasm.

Failure to gain weight and constipation are largely dependent upon the severity of the vomiting. In a mild case a sensible mother may be able to maintain the child's progress by additional feeding. In a number of the more severe cases there may be considerable dehydration and marasmus.

Iron deficiency anaemia is sometimes observed and is probably the result of a poor nutritional intake associated with chronic blood loss in the vomit and stools.

Visible gastric peristalsis is not unusual. This last sign and the sometimes projectile character of the vomiting make hypertrophic pyloric stenosis the main consideration in differential diagnosis in infancy. However, the history of vomiting *from birth*, the altered blood in the vomitus, and the absence of a palpable pyloric tumour should make the distinction from this condition; moreover, the visible gastric peristalsis is usually not of the degree seen in pyloric obstruction. All other causes of vomiting must be included in the differential diagnosis, *e.g.*, feeding problems, intestinal obstructions, intracranial lesions, aerophagy, other forms of diaphragmatic hernia, and renal acidosis. Haematemesis in the first week of life may result in an initial diagnosis of haemorrhagic disease of the newborn. Cases with vomiting of the first feedings after birth can resemble atresia of the oesophagus.

At or before the time of weaning onto solid food, a pronounced change in the symptomatology may take place. In the majority of children, estimated at about three-fourths of all patients, there is a great improvement. This continues so that most have ceased to vomit by the age of two years, or at the worst tend to vomit only with coughing or excitement. The remainder, *i.e.*, about one quarter of all cases, show little change or actually become worse when mixed feeding is introduced. In these children the course of the disease is more prolonged and it is uncommon for much improvement to take place before about four years, although after this age they, too, tend to make a gradual improvement. In this latter group who are not improved by weaning onto solids are a few, estimated at less than one-tenth of *all* cases, in whom the serious complication of an oesophageal stricture develops.

In all cases without an oesophageal stricture, the symptomatic improvement tends to follow a regular pattern. There are periodic vomiting attacks, separated by increasing periods of complete freedom. During this stage of recovery, some cases are erroneously considered as instances of cyclical vomiting; pertussis may be simulated when vomiting is precipitated by attacks of coughing.

RADIOLOGY

A continuous flow of contrast medium facilitates examination of the gastro-oesophageal junction. Therefore, whenever possible, in infancy a feeding bottle is used to administer the barium mixture, a 50 per cent W/V suspension. This is followed by a thicker mixture (100 per cent W/V), given by spoon.

Three aspects of the condition have to be studied, namely, the functional abnormality, *i.e.*, the gastro-oesophageal incompetence, the anatomical abnormality (partial thoracic stomach), and oesophageal complications.

Gastro-oesophageal incompetence is manifest by the abnormal reflux of barium from the stomach into the gullet. In gross instances it is suggested even before the contrast medium reaches the stomach; the barium shows hesitant progress, with up-and-down movement even in the upper oesophagus. When the medium reaches the stomach, it floods back freely above the diaphragm, moving in and out of the stomach synchronously with respira-

Fig. 2. J. G., age two weeks. Copious vomiting since birth, with loss of much weight. An ill child.
This is an example of the obvious type of minor partial thoracic stomach, with a constriction representing the cardia. Below this is an expanded area where both vertical and greater curvature-type gastric folds are visible above the diaphragm.

tion and usually soon provoking vomiting.

In many children, however, reflux is less obvious and only detected when induced by manoeuvres to raise intra-abdominal pressure. A convenient procedure is to lay the child supine with the head tilted downward at from 20 to 30 degrees, so that barium accumulates in the gastric fundus. Then firm abdominal pressure is applied as high under the ribs as possible, while further barium is being swallowed. Another useful manoeuvre is to rotate the child from this position into the left posterior oblique posture (relative to the screen), at the same time watching the gastro-oesophageal junction and pressing the abdomen. The rotation brings air into the fundus and may lead to the reflux of mixed air and barium.

All procedures may at first fail to provoke reflux, yet with perseverance eventually succeed. Once the initial occurrence of reflux has been induced, it may subsequently occur more readily. Occasionally all efforts fail until the child starts to cry.

Gastro-oesophageal incompetence has to be distinguished from (*a*) normal eructation; (*b*) the reflux that occurs in the presence of a high alimentary obstruction, *e.g.*, pyloric stenosis or duodenal obstruction; (*c*) the inco-ordinated swallowing sometimes seen with birth injuries or prematurity.

The Partial Thoracic Stomach: The gullet has a normal direct course, although it may appear wider and more "flabby" than usual. At a point from a few millimeters to three or four centimeters above the diaphragmatic hiatus there is a variable degree of constriction, where the passage of barium is slightly slowed (Fig. 2). This point indicates the cardia; below it the gullet expands into the thoracic stomach, which often lies asymmetrically with respect to the axis of the oesophagus. To distinguish the thoracic portion of the stomach from the phrenic ampulla (the normal, more symmetrical dilatation due to the temporary accumulation of barium above a closed cardia), a study of the mucosal pattern is important. In the oesophagus the mucosal folds are fine parallel longitudinal lines that are gathered together at the constriction representing the cardia; below this they diverge again in the thoracic stomach as *coarser* gastric folds that pass vertically through the diaphragm. In addition, in a certain number of instances irregular or secondary (greater curvature) type mucosal folds are also present in the loculus of thoracic stomach, giving a very characteristic appearance. The hiatus appears wider than usual. Below it the vertical folds are continuous with the rugae of the abdominal portion of the stomach, where they often have a radial or "tent-like" arrangement, and the normal obliquity between the oesophagus and stomach is reduced.

The all-important observation of the continuity of gastric mucosal folds above and below the diaphragm is best seen with the child supine and slightly rotated into the right anterior oblique position relative to the screen; rotation should be just sufficient to bring the lower part of the

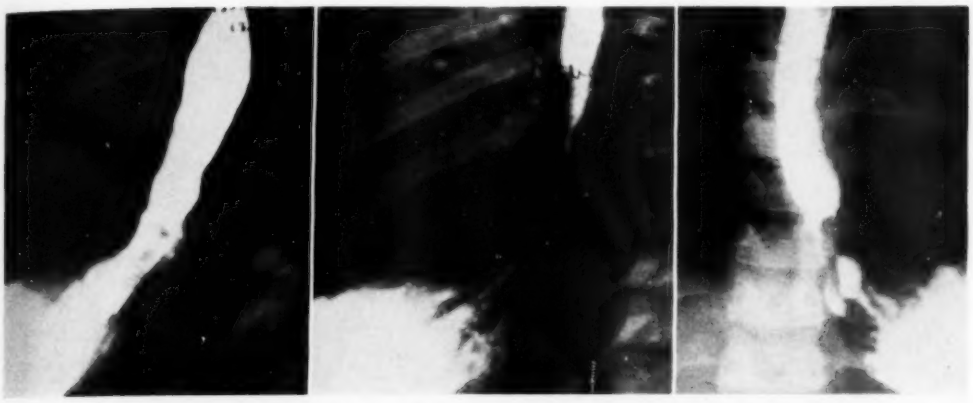


Fig. 3. R. D., age 17 months. Repeated attacks of vomiting since birth, occasionally with haematemesis. The partial thoracic stomach is not obvious in the picture to the extreme left, as there is only a very shallow constriction at the cardia, but mucosal pattern studies (reproduced in the other views) show the presence of coarse gastric folds above the diaphragm which are continuous through the hiatus with those of the abdominal portion of the stomach.

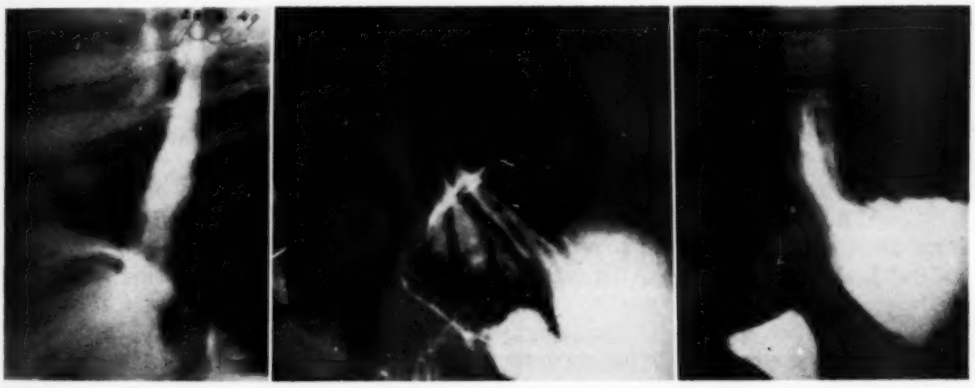


Fig. 4. W. L., age 14 months. Vomiting since birth, with blood in the vomitus on several occasions. Only a very shallow constriction indicates the site of the cardia in the film to the extreme left, but the hiatus appears wide and reflux occurs. The other films show the continuity of gastric folds above the diaphragm with those below, which have a radial arrangement. The normal gastro-oesophageal angle is lost.

gullet clear of the spine and reveal its exact relationship to the diaphragm. In addition, the nearly lateral left posterior oblique position, with reflux of air and lingering traces of barium, is useful to demonstrate the mucosal pattern.

So far the description has applied to the more easily detected variety of this condition. Difficulty occurs mainly in two ways: the site of the cardia may be ill-defined or the loculus of thoracic stomach may fail to distend sufficiently to reveal its true nature. When there is only a slight constriction at the gastro-oesophageal junction, it may be completely obliterated if the oesophagus is well filled, showing the gullet apparently as a normal tube-like structure. Under continued observation, however, momentary slight narrowing and slight hold-up of barium are usually to be detected, especially with small amounts of contrast medium. Then a study of the mucosal pattern will reveal the gathering together of the fine oesophageal folds at this level and the transition to the coarser gastric type that has been described previously (Figs. 3–5).

Failure of the thoracic stomach to

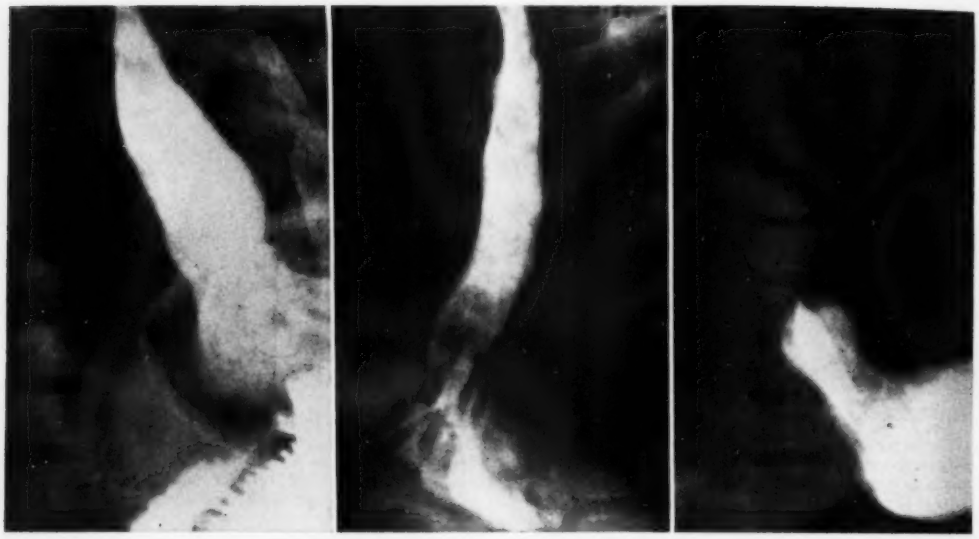


Fig. 5. A. B., age 6 months. Vomiting since birth, with occasional streaks of blood.
The film on the left shows a very wide hiatus, through which gastro-oesophageal reflux occurred. The other views show the continuity of gastric folds above and below the diaphragm, with loss of the normal gastro-oesophageal angle.

distend fully with barium is especially apt to occur when reflux is slight; the gullet may appear as a normal tube-like structure because the thoracic stomach is filled only from above by a jet that tends to retain the width of the oesophagus. Alternatively, if the constriction at the cardia is considerable, an even smaller jet may emerge into the thoracic stomach, so that the latter shows as an irregular or narrowed area just above the diaphragm. In either of these circumstances, promotion of complete filling of the thoracic stomach to reveal its true nature and extent is aided by the induction of reflux (to fill the loculus from below) or by manual abdominal compression to cause swallowed barium to accumulate at the lower end of the gullet. Nevertheless, abnormal appearances may be very transient and it may be impossible to record them adequately by "spot-films" —or even, we have found on occasion, by a series of radiographs at half-second intervals. For this reason careful fluoroscopic examination is of extreme importance and radiographs may be misleading.

In a small number of children with gastro-oesophageal incompetence we have found no certain radiological localisation of the cardia. The picture at first appeared that of cardio-oesophageal relaxation alone, but the normal angle between oesophagus and stomach was lost and gastric folds appeared to traverse a wide hiatus, although the exact point of transition to oesophageal mucosa was uncertain (Fig. 6). The gullet was at all times tubular, with no expanded portion just above the diaphragm. In one such infant, the presence of a thoracic stomach was confirmed at autopsy, and it may be that a proportion of infants considered to have simple cardio-oesophageal relaxation have in fact a partial thoracic stomach (16, 22).

Oesophageal and Other Complications: 1. *Oesophagitis* usually produces no radiological manifestations. Occasionally, however, we have found tiny irregularities of contour of the lower oesophagus, sometimes associated with slight narrowing, that were probably due to this complication (Fig. 7).

2. *Oesophageal strictures* occur in a small proportion of children, showing as a narrowed segment above the level of the cardia. The narrowing varies from a slight

reduction in oesophageal calibre, producing no appreciable obstruction to the passage of barium, to a severe stricture with proximal oesophageal hyperperistalsis, stasis and dilatation. In length it may be only a few millimeters, appearing as an

Fig. 6. P. D., age 6 years. Vomiting since birth, with blood in the vomitus from time to time.

Radiologically it was not possible to localise the site of the cardia, although the hiatus was wide, with loss of the normal gastro-oesophageal angle and continuity of gastric folds above and below the diaphragm. Reflux was gross.

Oesophagoscopy with a biopsy confirmed the presence of gastric mucosa above the diaphragm This is the type of partial thoracic stomach that simulates "chalasia."

accentuation of the constriction denoting the cardia, or it may measure several centimeters and have an irregular channel. Sometimes the stricture may be separated from the thoracic stomach by a short portion of apparently normal oesophagus

Fig. 7. L. H., age 12 days. Vomiting since the second day of life, projectile at times. There was blood in the vomitus on the second and third days.

There is an obvious minor partial thoracic stomach, containing both vertical and greater curvature-type mucosal folds; much reflux occurs. In addition, a considerable part of the oesophagus has tiny irregularities of outline, with slight narrowing.

Six months later, vomiting had decreased; the thoracic stomach was unchanged but reflux seemed less. The narrowing and irregularities had gone, indicating that they were probably due to oesophagitis with oedema and mucosal erosions.

(Fig. 8). Radiographs are apt to exaggerate the length of the narrowed segment because of the jet-like flow of emerging barium. Complete filling of the partial thoracic stomach and lower oesophagus is essential for demonstration of the true length (Fig. 10). When a stricture is present, the exact site of the cardia is often difficult to locate, and the presence of the thoracic stomach may be less obvious; nevertheless, it is possible in most instances to define gastric rugae passing above the diaphragm.

3. *Oedema and spasm of the oesophageal* wall play a considerable part in the production of a radiological narrowing and are sometimes more important than fibrosis. It may be found that the calibre of a

narrowed segment increases during the course of an examination, presumably as spasm relaxes. Considerable change may also occur after only a few days of medical treatment. Similarly, a narrowing that appears severe in the radiograph may sometimes permit the free passage of an oesophagoscope when there is relaxation under anaesthesia.

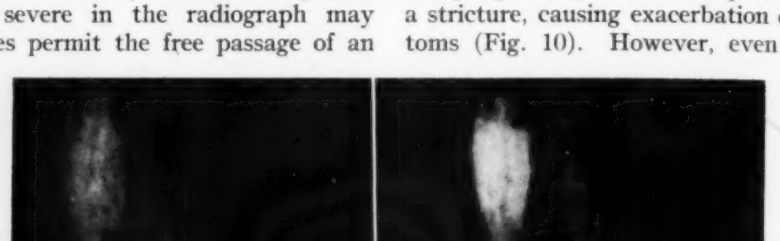


Fig. 8. P. M., age 3 years. Vomiting from early infancy. At one time the patient was considered to have pyloric stenosis and was treated by antispasmodics without effect.

Partial thoracic stomach with a mild oesophageal stricture. There is a tiny projection from the stricture that may indicate an ulcer. Between the stricture and the thoracic stomach is a short length of oesophagus that is not narrowed. It is important to remember this possibility when taking an oesophagoscopy biopsy specimen to prove the presence of thoracic stomach below a stricture.

In a few small babies we have seen a very considerable hold-up just above the diaphragm that could be attributed almost entirely to spasm. In one instance this disappeared completely within a few days and it became possible to demonstrate the thoracic stomach; in another child, the obstruction suddenly disappeared during fluoroscopy.

4. *Oesophageal ulceration:* Superficial erosion occurring in oesophagitis is usually not detected, although it may be responsible for the tiny irregularities mentioned previously. In a number of children, deeper, ulcer-like niches are seen, usually along the line of an oesophageal stricture (Fig. 9).

5. *Impacted foreign bodies:* Objects that would probably normally pass through the oesophagus may become impacted above a stricture, causing exacerbation of symptoms (Fig. 10). However, even when a stricture is absent, a child may suffer from occasional episodes when food seems to stick in the gullet until dislodged by drinking or retching. Probable factors are reflex spasm and reduced oesophageal elasticity.

6. *Pyloric abnormalities:* In 5 children there was hypertrophic pyloric stenosis (confirmed at operation in 4) in addition to the partial thoracic stomach. Symptoms attributable to the gastro-oesophageal incompetence (including vomiting of blood) commenced soon after birth. Vomiting then increased after a few weeks, *i.e.*, at the age when vomiting due to pyloric stenosis is usually maximal.

In another 3 children there was "infantile

pylorospasm" (*i.e.*, inconstant narrowing of the pyloric antrum) (23). A possible relationship of this phenomenon to excessive aerophagy has been suggested (24).

7. A *gastric ulcer* occasionally occurs in the thoracic stomach; Barrett (25) described this in a boy of thirteen but we ourselves have not seen it.

Radiological Progress: In children whose vomiting gradually ceases, gastro-oesophageal reflux becomes less or disappears altogether. It is our impression that in the vast majority (and possibly *all* of the cases), the partial thoracic stomach persists, although its detection becomes much more difficult and sometimes uncertain. This is because the supradiaphragmatic loculus can no longer be distended fully with the aid of reflux from below. The valve mechanism between oesophagus and stomach becomes more effective in two ways. At first, reflux may still occur from the abdominal to the thoracic portion of the stomach, although barium does not pass above the cardia. This suggests improved sphincteric action (or a general increase in tone) in the oesophagus itself. Later, reflux ceases at the level of the diaphragm, as if the "pinchcock" mechanism of the right crus has become effective even though it is surrounding a part of the gastric fundus.

Borderline Cases: There are a number of children with a characteristic history in whom the radiological examination is doubtful or negative. Some of these will give positive findings at a subsequent examination, when reflux occurs to reveal the anatomical abnormality. Therefore, with a strongly suggestive history, a negative fluoroscopic examination should be regarded with some reserve.

A small number of children with a suggestive history will remain radiologically negative. It may be that there are borderline instances of gastro-oesophageal incompetence that cannot necessarily be detected (24).

Although we have sometimes employed endoscopic examination as a diagnostic aid, we do not regard it justifiable as a routine investigation in small children, especially in a condition that is usually benign. It does, however, have considerable value in the more severe case, especially if complicated by an oesophageal stricture or impacted foreign body, and it is an advisable confirmatory measure in the few cases where operative treatment becomes necessary.

Fig. 9. C. S., age 5 years. Vomiting from birth. Dysphagia.
There is an oesophageal stricture, with an ulcer-like niche. The loculus of thoracic stomach was very difficult to demonstrate radiologically, although it was confirmed at subsequent thoracotomy.

TREATMENT

In view of the essentially benign course of gastro-oesophageal incompetence in the majority of infants, we believe that conservative treatment in infancy is to be

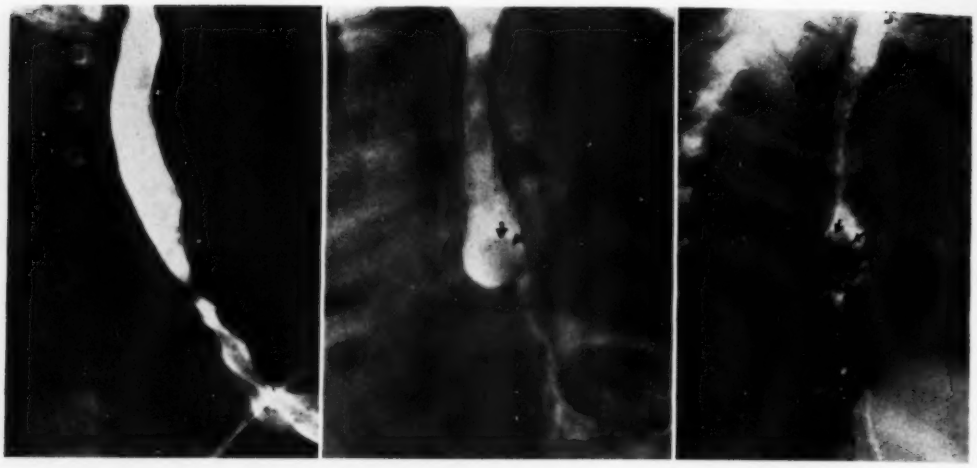


Fig. 10. J. J., age 17 months. Vomiting from birth, becoming worse on weaning to solids.
The view at the extreme left shows a minor partial thoracic stomach with a short oesophageal stricture above it. Six weeks later, the vomiting increased in severity.
The other views show an oval, mobile translucency in the barium above the oesophageal stricture (arrows). At oesophagoscopy, a fruit stone was removed and the vomiting became less.
The apparent increase in the length of the stricture, as shown by the center film, is an example of the "jet effect" of barium passing through a narrowing that is really quite short (compare the second and third pictures).

favoured (16). The babies are nursed, both day and night, in a propped-up position that is maintained by a special harness. Simply elevating the head of the cot is insufficient. If vomiting persists, thickened feedings are also given.

It appears reasonable to hope that early diagnosis and prompt institution of these conservative measures will reduce the number of children who develop oesophageal strictures and need radical surgical treatment.

SUMMARY

1. Gastro-oesophageal incompetence due to a "short oesophagus" and a minor degree of partial thoracic stomach is a not uncommon cause of vomiting in infancy.

2. The vomiting usually dates from the neonatal period and in many cases the vomitus contains altered blood from time to time.

3. In early infancy the vomiting is often projectile and there may be visible gastric peristalsis, making differentiation from hypertrophic pyloric stenosis important.

4. Weaning to solid food frequently causes improvement, and, if this occurs, symptoms usually cease by about two years of age. If weaning causes no improvement, a longer course is likely. In a small proportion of cases of the latter group an oesophageal stricture develops, secondary to reflux oesophagitis.

5. Radiological diagnosis consists of recognition of gastro-oesophageal incompetence and the identification of stomach above the diaphragm. The latter depends mainly upon the detection of the site of change of an oesophageal to a gastric mucosal pattern.

6. Although sometimes the radiological diagnosis may be easy, it often requires considerable care and experience. Several examinations are sometimes necessary, and a number of cases with a suggestive history remain radiologically negative.

7. Complications that may be recognised radiologically include oesophageal spasm and ulceration, stricture formation, impacted foreign bodies, and pyloric abnormalities.

8. Treatment in infancy consists of nursing in a propped-up position, maintained by a special harness. Thickened

feedings are given if vomiting is persistent.

9. Early diagnosis and treatment may reduce the incidence of complicating oesophageal strictures.

ACKNOWLEDGMENTS: We are indebted to Dr. Frances Braid, Mr. A. L. d'Abreu, Prof. J. M. Smellie, and Dr. Cecil G. Teall for their help and encouragement. We are grateful, also, to the consultant staff of The Children's Hospital, Birmingham, whose patients we studied.

The Childrens Hospital
Ladywood Road, Edgbaston
Birmingham 16, England

REFERENCES

1. LELONG, M., AIME, P., AND AUBIN, A.: Le brachy-oesophage chez le nourrisson. Presse méd. **49:** 106–109, Jan. 28, 1941.
2. NICOD, M.: Vomissements par anomalies oesophago-gastriques chez le nourrisson. Praxis **37:** 745–754, Oct. 7, 1948.
3. NEUHAUSER, E. B. D., AND BERENBERG, W.: Cardio-Esophageal Relaxation as a Cause of Vomiting in Infants. Radiology **48:** 480–483, May 1947.
4. BERENBERG, W., AND NEUHAUSER, E. B. D.: Cardio-Esophageal Relaxation (Chalasia) as a Cause of Vomiting in Infants. Pediatrics **5:** 414–419, March 1950.
5. ALLEN, R. P.: Cardio-Esophageal Relaxation. Radiology **55:** 214–217, August 1950.
6. LENDRUM, F. C.: Anatomic Features of the Cardiac Orifice of the Stomach, with Special Reference to Cardiospasm. Arch. Int. Med. **59:** 474–511, March 1937.
7. DICK, R. C. S., AND HURST, A.: Chronic Peptic Ulcer of the Oesophagus and Its Association with Congenitally Short Oesophagus and Diaphragmatic Hernia. Quart. J. Med. **11:** 105–120, April 1942.
8. SHANKS, S. C.: Hiatus Hernia. Brit. J. Radiol. **21:** 55–66, February 1948.
9. JOHNSTONE, A. S.: Diagnosis of Early Gastric Herniation at the Oesophageal Hiatus. J. Fac. Radiologists **3:** 52–65, July 1951.
10. ALLISON, P. R.: Reflux Esophagitis, Sliding Hiatal Hernia and the Anatomy of Repair. Surg. Gynec. & Obst. **92:** 419–431, April 1951.
11. BEATTY, C. C.: Congenital Stenosis of the Oesophagus. Brit. J. Child. Dis. **25:** 237–270, October-December 1928.
12. SHELDON, W., AND OGILVIE, A. G.: Obstruction of the Oesophagus in Childhood. Arch. Dis. Childhood **4:** 347–364, December 1929.
13. KELLY, A. B.: Congenital Stenosis of the Oesophagus in Children, Associated with Diaphragmatic Hernia of the Stomach. J. Laryng. & Otol. **45:** 680–685, October 1930.
14. FINDLAY, L., AND KELLY, A. B.: Congenital Shortening of the Oesophagus and the Thoracic Stomach Resulting Therefrom. J. Laryng. & Otol. **46:** 797–816, December 1931.
15. CLERF, L. H., AND MANGES, W. F.: The Congenitally Short Oesophagus. J.A.M.A. **102:** 2008–2012, June 16, 1934.
16. CARRÉ, I. J., ASTLEY, R., AND SMELLIE, J. M.: Minor Degrees of Partial Thoracic Stomach in Children. Lancet **2:** 1150–1153, Dec. 13, 1952.
17. SMITHERS, D. W.: The Association of Cancer of the Gastric Cardia with Partial Thoracic Stomach, Short Oesophagus and Peptic Ulceration. Brit. J. Radiol. **23:** 261–269, May 1950.
18. JOHNSTONE, A. S.: Peptic Ulceration of the Oesophagus with Partial Thoracic Stomach. Brit. J. Radiol. **16:** 357–361, December 1943.
19. ALLISON, P. R.: Peptic Ulcer of the Oesophagus. Thorax **3:** 20–42, March 1948.
20. HUSPELDT, E., THOMSEN, G., AND WAMBERG, E.: Hiatal Hernia and Short Oesophagus in Children. Thorax **6:** 56–70, March 1951.
21. BELSEY, R.: In Modern Trends in Gastro-Enterology, edited by F. Avery Jones, London, Butterworth & Co., 1952, Chap. 7, pp. 128–177.
22. ROVIRALTA, E.: Sur quelques causes des vomissements dits "habituels" du nourrisson. Helv. paed. acta **4:** 445–454, 1949.
23. ASTLEY, R.: The Radiology of Infantile Pyloric Stenosis. I. Radiology of "Atypical" Hypertrophic Pyloric Stenosis. Brit. J. Radiol. **25:** 342–350, July 1952.
24. WOOD, B. W., AND ASTLEY, R.: Vomiting of Uncertain Origin in Young Infants. Arch. Dis. Childhood **27:** 562–568, 1952.
25. BARRETT, N. R.: Chronic Peptic Ulcer of the Oesophagus and "Oesophagitis." Brit. J. Surg. **38:** 175–182, October 1950.

SUMARIO

Insuficiencia Gastro-Esofágica en los Niños, con Referencia Particular a las Formas Menores de Estómago Parcialmente Torácico

La insuficiencia gastro-esofágica debida a un esófago corto y a una forma leve de estómago parcialmente torácico no es una causa rara de vómito en la infancia. El vómito puede comenzar poco después del nacimiento y ser en proyectil. Las materias vomitadas pueden contener de cuando en cuando sangre alterada.

El destete y una dieta a alimento sólido van frecuentemente seguidos de mejoría y, si así sucede, los síntomas suelen cesar para la edad de dos años. Si el destete no logra mejoría, es probable que la evolución sea más larga. En una pequeña proporción de los casos de este último grupo, se presenta una estenosis esofágica, secundaria a esofagitis de reflujo.

El diagnóstico radiológico se basa en el reconocimiento de la insuficiencia gastro-esofágica y la identificación del estómago

más arriba del diafragma. La última depende en gran parte del descubrimiento de que el patrón de la mucosa ha cambiado de esofágico a gástrico. Con frecuencia se necesitan repetidos exámenes radiológicos y cierto número de casos con una historia clínica indicativa permanecen negativos radiológicamente. Las complicaciones que cabe reconocer radiológicamente comprenden espasmo y ulceración, estenosis y cuerpos extraños encajados en el esófago y anomalías pilóricas.

El tratamiento en la infancia consiste en la alimentación suministrada en una posición "apoyada," mantenida por medio de un arnés especial. Si el vómito continúa, están indicadas comidas espesas. El diagnóstico y tratamiento tempranos pueden reducir la incidencia de las estrecheces del esófago como complicación.

The Roentgen Diagnosis of Gallstone Ileus[1]

THOMAS W. DORR, M.D.[2]

THERE ARE many communications in the literature describing gallstone or biliary ileus. In the period 1941 to 1950 88 papers on this subject were published. The majority of these are isolated case reports and few deal solely with the radiographic diagnosis.

Two factors serve to re-alert roentgenologists to an understanding and diagnosis of gallstone ileus. One is the high mortality of the disease; the other is the number of reports of gallstone obstruction from the surgical point of view which fail to mention the roentgen findings. As recently as 1950 a report (1) of 7 cases in which gallstone ileus was found at operation stated that "the roentgenographic examination appears to be of little value." None of these cases were diagnosed before surgery. Denneen and Broderick (2) reported 1 case in a series of 10 which was recognized preoperatively.

The present paper is based upon 8 cases in which the diagnosis was made or suggested prior to surgery or death. Four of these will be reported in some detail. In the opinion of the author, in the great majority of patients with this disease a diagnosis can easily be made. Early diagnosis is essential, since there is a notoriously long delay between the onset of symptoms and operation. The advanced age of most of the patients and concurrent cardiovascular-renal disease are additional reasons for the 50 per cent mortality which is the mean for this condition.

In 1941, Rigler and his associates (3) reported 14 cases of gallstone ileus and discussed the diagnostic signs. The tenth published case of recurrent gallstone ileus was contributed by Noskin and Tannenbaum (4) in 1952. Lomhoff and Dubowy (5) reported a case of gallstone ileus associated with diverticulitis of the colon. The discovery of an obstructing calculus in the sigmoid, with the sigmoidoscope, was described by d'Abreu (6). Mayo and Brown (7), in 1949, reported the surgical aspects of 18 cases.

Five diagnoses[3] of mechanical ileus caused by an impacted gallstone were made at the Evanston Hospital from 1940 through 1951; this number represented 2.5 per cent of the 229 mechanical bowel obstructions in patients over eighteen years of age seen during that interval. This figure is in close agreement with those of Frimann-Dahl (8), 2 per cent, and of Rigler *et al.*, 0.4 to 5.0 per cent. Recently Nemir (9) reported 8 cases of gallstone ileus treated surgically, representing 1.4 per cent of 549 cases of mechanical intestinal obstructions of all kinds.

Erosion through the wall of the gallbladder into the alimentary canal is the common path by which a biliary calculus may gain entrance to the gut. A fistula is necessarily formed, usually cholecystoduodenal or cholecystojejunal. Rigler reported a choledochoduodenal fistula derived from the passage of a stone through the wall of the distal common duct into the duodenum. Many authors doubt if gallstones ever reach the intestine *via* natural channels. All but 2 of the patients in the series reported here had fistulae. Failure to demonstrate a fistula may be explained by inflammation and fibrosis which follow erosion by the gallstone, thus obscuring the normal anatomy, or the fistula may disappear rapidly for the same reasons, *i.e.*, inflammation and fibrosis.

---

[1] From the Department of Radiology, Northwestern University Medical School, Ralph G. Willy, M.D., Assistant Professor and Director of the Department of Radiology, Evanston Hospital. Accepted for publication in April 1953.

[2] Resident in Radiology, Evanston Hospital and the Graduate Division of Northwestern University Medical School, Chicago, Ill.

[3] The 3 additional cases were diagnosed at Swedish Covenant Hospital, Chicago.

Fig. 1. Case I. Air in the biliary tree. At the ligament of Treitz the barium column is halted, outlining the stone.

The symptoms are not characteristic but usually indicate an obturation of the small bowel. Colicky abdominal pain, nausea, and vomiting are generally present. In many reported series, a history of previous gallbladder disease is said to have been present as often as it was absent. In one review of 150 cases, 15 per cent of the patients were jaundiced.

The cardinal roentgenographic sign is the presence of air or barium in the biliary tree. The air originates from the intestine, traveling through the fistula into the gallbladder and cystic duct and then into the bile radicals, only the proximal portions of which are usually visualized. A barium outline of the biliary tract is obtained as the contrast medium replaces the air following administration of a barium meal. Case I illustrates these factors.

CASE I: Mrs. A. P., 83 years old, entered the hospital April 30, 1949, complaining of severe cramps in the upper abdomen, nausea, and vomiting of three days duration. A similar episode had occurred ten days previously.

Roentgen Examination, May 2, 1949: A routine examination of the upper gastrointestinal tract demonstrated air in the biliary tree. The barium column halted in the jejunum immediately distal to the ligament of Treitz (Fig. 1).

May 3, 1949: Barium was seen in the dilated common bile duct, hepatic radicals, and in the shrunken gallbladder. That the calculus had traveled further was indicated by a barium-filled loop which was longer and more dilated than on the previous day (Fig. 2).

Operation, May 4, 1949: A gallstone 7 cm. in diameter was removed from the jejunum. A

Fig. 2. Case I. In twenty-four hours the barium column has progressed only to the location indicated by the arrow. Barium has entered the biliary radicals and the shrunken gallbladder.

cholecystoduodenal fistula was discovered. The patient died ten days later of peritonitis arising from a jejunotomy leak.

Since the small intestine narrows in caliber from the ligament of Treitz to the terminal ileum, the latter is usually the site of obstruction. The determination of the actual perforation of the gallbladder by the calculus and the event of obstruction is generally impossible, because there is rarely a history of sudden pain or epigastric distress. The gallstones themselves, with a minimum diameter of 2.5 cm., were the obstructing factors in the cases upon which this report is based. Some authors claim that a small gallstone may act as a nidus for intestinal contents, thus creating a larger mass, which is then able to produce obstruction.

The second sign concerns the calculus

itself. Cases II and III showed a large laminated calcification in an area other than the gallbladder region.

CASE II: Mrs. L. W., 61 years of age, a white housewife, entered the hospital Aug. 8, 1949, complaining of cramping pain in the left lower quadrant, nausea, and vomiting of two days duration. A

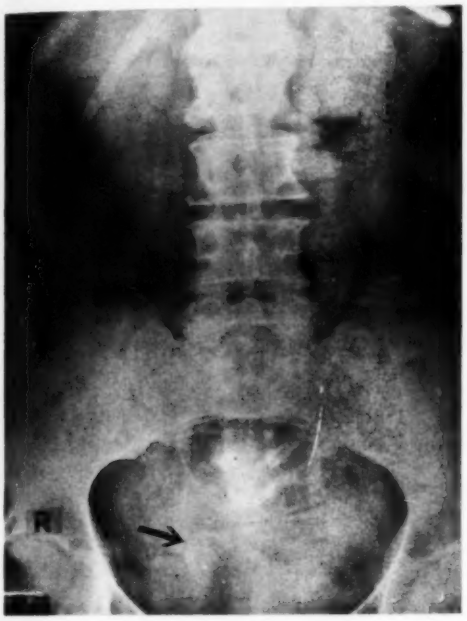


Fig. 3. Case II. Single dilated loop leading to gallstone in the pelvis.

twenty-year history of occasional gallbladder attacks was recorded. The patient had old chronic rheumatic heart disease with many episodes of congestive failure.

Roentgen Examination, Aug. 8, 1949: A distended loop of small bowel led to a single laminated shadow in the lower right pelvis (Fig. 3).

Operation, Aug. 8, 1949: A gallstone 2.5 cm. in diameter was removed from the terminal ileum. Recovery was uneventful.

CASE III: Miss E. C., 55 years of age, a teacher, was admitted to Evanston Hospital, April 17, 1944, in shock and dehydration and expired twenty minutes later. A scout film of the abdomen was taken before death. The patient had had abdominal pain, nausea, and vomiting for three weeks prior to admission. There was a long history of cholecystitis. In 1936, a single gallstone had been demonstrated in the gallbladder area.

Roentgen Examination, April 17, 1944: Moderate distention of the small bowel, stepladder fluid levels, and a laminated shadow in the right lower quadrant

Fig. 4. Case III. Many dilated loops; gallstone over right ileum.

were demonstrated. There was a suggestion of air in the biliary tree. A calcified mass was seen in the right pelvis (Fig. 4).

Postmortem Findings: Intestinal obstruction by a gallstone 3.0 cm. in diameter, impacted in the ileum; cholecystoduodenal fistula; chronic cholecystitis and cholelithiasis; calcified uterine fibromyoma.

The absence or a change in location of a previously noted gallstone, air in the biliary tree, and dilated loops of small bowel constitute the diagnostic triad as demonstrated in the following case.

CASE IV: Mrs. G. F., 61 years of age, a white housewife, entered the hospital on Jan. 20, 1949, complaining of nausea and vomiting of four days duration; right upper quadrant pain and clay-colored stools were reported. She had experienced a gallbladder attack in 1945.

Roentgen Examination, Sept. 25, 1945: A single laminated shadow was seen, overlying the mid-portion of the eleventh rib on the right (Fig. 5).

Jan. 22, 1949: A small bowel obstruction was indicated by multiple fluid- and gas-distended loops. Air was present in the bile passages. There was a change in position of the gallstone, now located over the distal end of the twelfth rib on the right (Fig. 6).

Operation, Jan. 22, 1949: A gallstone 3 cm. in diameter was removed from the jejunum, from which a fistula extended to the gallbladder. The patient died in an anuric state one week later.

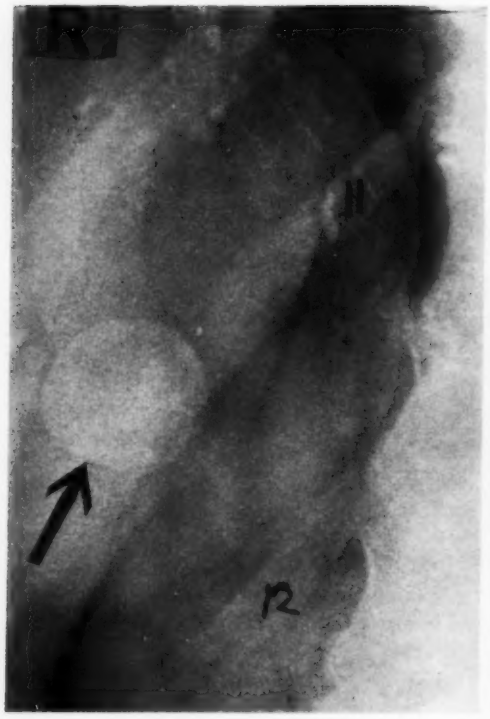


Fig. 5. Case IV. Gallstone over mid-portion of 11th rib

SUMMARY

Gallstone ileus represents approximately 2 per cent of all intestinal obstructions in adults. Accurate and early diagnosis is essential to reduce the high mortality.

The diagnostic signs are as follows: (1) signs of small bowel obstruction; (2) air or contrast medium in the biliary tree; (3) absence or change of location of a previously noted gallstone or a gallstone shadow located in an area other than the right upper quadrant.

NOTE: The author is grateful to Mr. Donald W. Burge, Chief of the Photographic Department of Evanston Hospital, for preparing the reproductions of the roentgenograms.

Evanston Hospital Association
Evanston, Ill.

REFERENCES

1. FORESTER, V. R.: Gallstone Ileus. Gastroenterology **15:** 679–683, August 1950.

2. DENNEEN, E. V., AND BRODERICK, T. C.: Gallstone Intestinal Obstruction. Ann. Surg. **131:** 225–236, February 1950.

3. RIGLER, L. G., BORMAN, C. N., AND NOBLE, J. F.: Gallstone Obstruction; Pathogenesis and Roentgen Manifestations. J.A.M.A. **117:** 1753–1759, Nov. 22, 1941.

4. NOSKIN, E. A., AND TANNENBAUM, W. J.: Recurrent Gallstone Ileus. A Case Report. Surgery **31:** 599–601, April 1952.

5. LOMHOFF, I. I., AND DUBOWY, J.: Gallstone Ileus Associated with Diverticulitis of the Colon. A Case Report. Am. J. Roentgenol. **60:** 86–89, July 1948.

6. d'ABREU, A. J.: Unusual Termination of Intestinal Obstruction Due to Gallstone. Brit. M. J. **2:** 388, Sept. 22, 1945.

7. MAYO, C. W., AND BROWN, P. W.: Intestinal Obstruction Caused by a Gallstone. Surgery **25:** 924–930, June 1949.

8. FRIMANN-DAHL, J.: Roentgen Examination in Acute Abdominal Diseases. Springfield, Ill., Chas. C Thomas, 1951.

9. NEMIR, P., JR.: Gallstone Ileus. Report of Eight Cases. Surg., Gynec. & Obst. **94:** 469–474, April 1952.

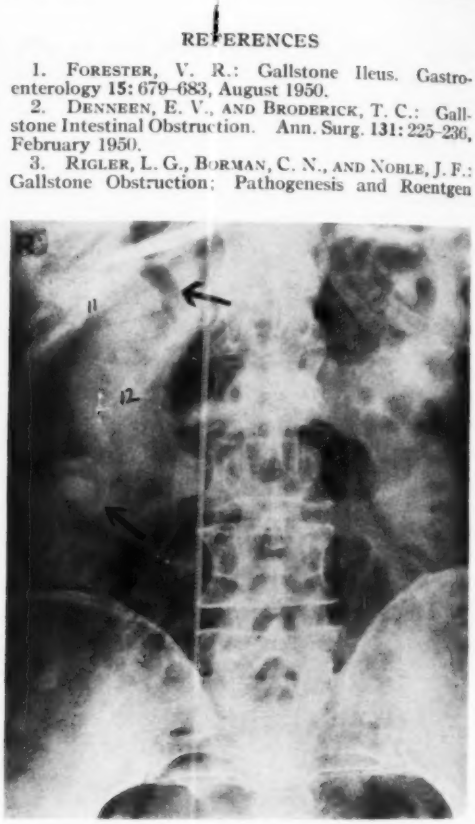


Fig. 6. Case IV. Four years after the roentgenogram reproduced in Fig. 5 was obtained, the stone has moved to the end of the 12th rib. Air in biliary tract and dilated loops.

SUMARIO

El Diagnóstico Roentgenológico del Ileo Colelitiásico

El íleo colelitiásico representa aproximadamente 2 por ciento de todas las oclusiones intestinales observadas en personas adultas. El diagnóstico exacto y temprano es indispensable para rebajar la elevada mortalidad de esa dolencia.

Los signos diagnósticos son los siguientes: (1) signos de oclusión del intestino delgado; (2) aire o medio de contraste en el árbol biliar; (3) ausencia o cambio de sitio de un cálculo notado anteriormente o una sombra de cálculo localizada en una zona distinta del hipocondrio derecho.

El trabajo actual se basa en 8 casos en que el diagnóstico fué verificado o sugerido antes de la cirugía o de la muerte. Cuatro de los casos son discutidos con bastante pormenor.

The Purged Colon[1]

F. C. JEWELL, M.D.,[2] and JOHN R. KLINE, M.D.[3]

IN 1943, Heilbrun published an article on extensive changes in the colon, apparently as a result of excessive and prolonged use of irritant cathartics. To our knowledge, no other report on this subject has appeared in the literature. During the past two years we have seen 2 patients with changes in the colon very similar to those described by Heilbrun. A brief résumé of his case and a report of our own cases follow. All 3 of these cases were thoroughly studied. Only the pertinent data are presented.

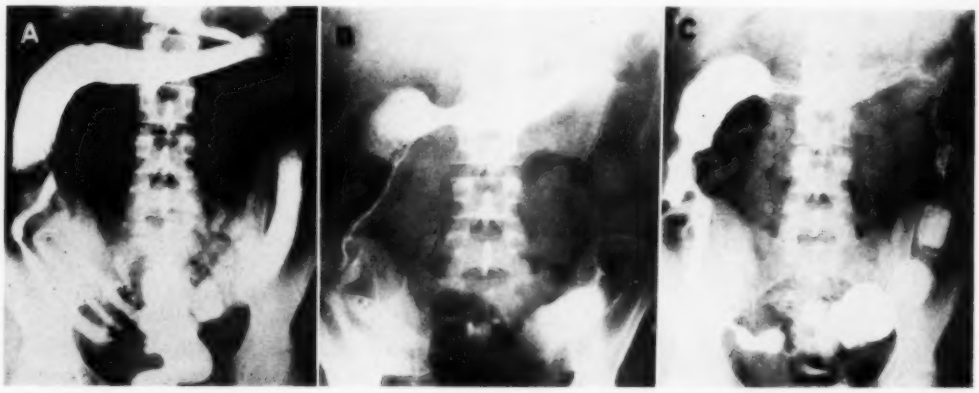


Fig. 1. Case I (Heilbrun). A. Initial film, showing tube-like ileum and shortened, narrowed colon without haustrations. B. Air-contrast study, showing abnormal mucous membrane. C. Film obtained after five months abstention from cathartics, showing evidence of increased activity of the left side of the colon. A film obtained after one month without cathartics was practically identical.

CASE REPORTS

CASE I (Heilbrun): A 36-year-old white female had from adolescence experienced a feeling of abdominal fullness and bloating, which seemed to be relieved by a complete evacuation. To insure this evacuation, she had taken cathartic tablets daily for the past twenty years. The cathartic was a well known patent medicine containing phenolphthalein, aloin, and podophyllum.

During this twenty-year period the feeling of bloating and fullness persisted, although the patient's general health and nutrition remained good. In November 1938, a gastrointestinal examination and barium enema study were done to determine whether any organic defects existed to account for the patient's complaints.

There was considerable delay in transit time of the barium meal through the small bowel. No recognizable mucosal pattern could be seen in the distal ileum, and it had a rigid, tube-like appearance. The colon was narrowed, spastic, lacking in haustrations, and without the normal mucous membrane pattern. The radiographic appearance was that of an advanced chronic ulcerative colitis, though there was nothing in the patient's history to suggest such a diagnosis. She denied any period of weight loss, diarrhea, loose stools, or daily fever.

The patient refrained from ingestion of any cathartic for one month and was then re-examined. No appreciable change was seen in the right side of the colon, but there was some increased activity of the left side. After five months without cathartics, there was no further improvement.

The patient gave up the use of cathartics for only six months, after which she gradually returned to her daily purgation. She was examined again in 1951, and the colon had not changed in appearance. Her general health remained good.

CASE II: A 54-year-old white female was admitted to the hospital Nov. 22, 1950, because of anorexia of long standing and recent severe nausea and vomiting. Questioning revealed that the patient had taken either eight cathartic pills or six ounces of

[1] Accepted for publication in April 1953.
[2] Formerly, Detroit, Mich.
[3] Wichita, Kans.

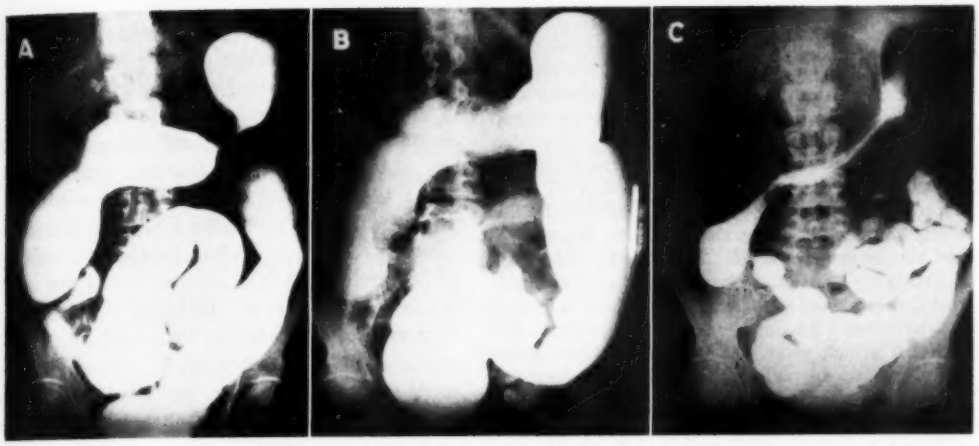


Fig. 2. Case II. A. Film showing persistent area of spasm of the left transverse colon. B. Loss of hepatic flexure and gaping ileocecal valve. C. Mucosal changes and shortening of the right side of the colon.

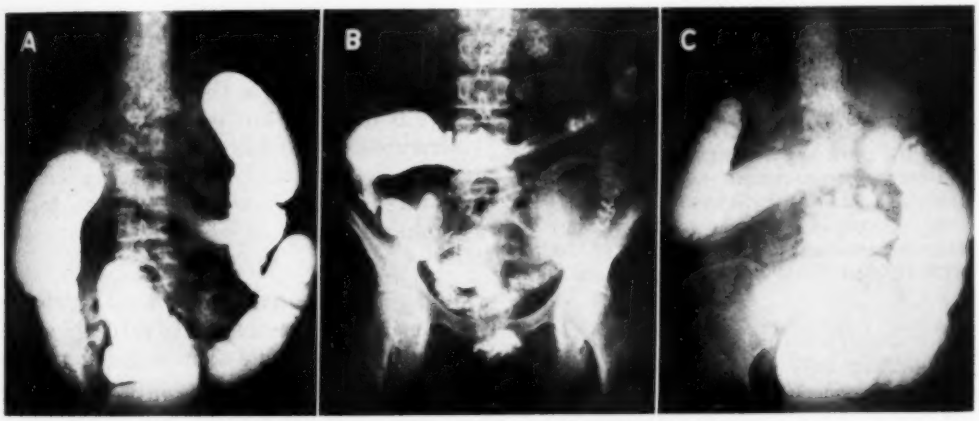


Fig. 3. Case III. A. Dilatation of the right colon and marked widening of the terminal ileum. B. Abnormal appearance of the mucous membrane of the right colon. C. Film obtained after fifteen months without cathartics. The right colon is considerably improved.

milk of magnesia every day for the past thirty years to relieve a feeling of discomfort and bloating in the upper abdomen. Under this regimen she had what she considered normal bowel movements. The cathartic used was the same preparation as that taken by Heilbrun's patient (Case I).

A plain film of the abdomen showed a long shadow in the right upper quadrant which was thought to represent a calcified gallbladder. A cholecystogram was done but the gallbladder was not visualized.

Furthur examination, by barium enema, showed the colon to be dilated and atonic. The hepatic flexure had almost disappeared. No normal mucous membrane pattern was present. The changes were much more marked on the right than the left, as in Heilbrun's case. The ileocecal valve was wide and gaping, and at times the terminal ileum was considerably dilated. There was an area of narrowing on the left side of the transverse colon which persisted throughout the first examination. It was not demonstrated on any of the other films. The upper gastrointestinal examination did not reveal any delay in transit time through the small bowel.

CASE III: A 63-year-old white female was admitted to the hospital Nov. 14, 1951, because of gastric distress. A plain film of the abdomen showed multiple small stone shadows in the upper mid abdomen. These were interpreted as pancreatic calculi and were thought to be the source of the patient's complaints.

A routine barium enema showed dilatation and atonicity of the right side of the colon, with the peculiar, rather characteristic change in the mucous membrane seen in the preceding cases. There were shortening of the hepatic flexure and marked widening of the terminal ileum. The left side of the colon emptied well, and the mucous membrane of the distal half of the descending colon and sigmoid colon appeared normal. As Heilbrun postulated, this entity seems to begin on the right side of the colon and may or may not involve the left side.

Following the colon examination, a detailed cathartic history was obtained. The patient had taken laxatives every day for the past twenty years. For the past fifteen years, she had taken three tablets daily, containing podophyllum, aloin, cascara and stramonium. In addition, milk of magnesia and licorice powder were used spasmodically.

A re-examination of the colon was done in January 1953, almost fifteen months after the original study. During this time, on the advice of her physician, the patient had been taking Metamucil for relief of her chronic constipation. This treatment was quite successful. Surprisingly, there was also marked improvement in the appearance of the colon. The hepatic flexure had lengthened and assumed a more normal shape. There was still pronounced dilatation of the distal ileum. However, the small bowel contracted normally and the mucous membrane pattern was normal. The entire colon also showed a considerable degree of contraction. There was still an abnormal appearance to the mucous membrane of the right side of the colon, with residual thickening of the mucosal folds.

COMMENT

One can only speculate on the relationship between the changes seen in the colon in these cases and excessive purgation. It is interesting that aloin and podophyllum were common to all three laxatives used and that all are classed as irritant cathartics. Probably essentially the same combination of ingredients is used in most cathartic preparations. The prolonged and excessive irritation of the colonic mucosa undoubtedly keeps it markedly edematous, effacing the normal pattern. Fibrosis could well occur in the submucosal structures, making the changes more or less permanent. The constant stimulation of the musculature may cause the muscle fibers to lose their tone, with the resulting dilatation and atonicity illustrated in the cases presented. The prolonged period of spasm of the left side of the colon seen in Case II may be on the basis of remaining hyperirritability of the musculature of this section of the bowel wall. Aloin is the most irritating of the emodin cathartics, causing increased irritability of the nerve endings in the wall of the large bowel. It may be this drug which produces such isolated areas of contracture.

In a recent communication, Heilbrun stated that he has examined 3 more patients who apparently belong in this group. We believe this radiographic picture is not rare, but rather is being misinterpreted, probably as old burned-out ulcerative colitis. An adequate clinical history should leave no doubt as to the diagnosis.

SUMMARY

1. Three cases of marked changes in the colon due to excessive use of cathartics have been presented, and some suggestions as to their mechanism of production are offered.

2. These changes probably are not rare, but are not being recognized as due to cathartics.

928 No. Emporia
Wichita, Kans.

REFERENCE

HEILBRUN, N.: Roentgen Evidence Suggesting Enterocolitis Associated with Prolonged Cathartic Abuse. Radiology 41: 486–491, November 1943.

SUMARIO

El Colon Purgado

Preséntanse 3 casos en que el colon mostraba alteraciones observables roentgenológicamente, debidas al empleo prolongado de catárticos irritantes. Uno de esos casos ha sido ya comunicado por Heilbrun en 1943.

Todos los enfermos revelaron falta del patrón normal de la mucosa. Los laxantes usados contenían aloína y podofilo, substancias estas consideradas ambas como catárticos irritantes. Aunque sólo cabe teorizar acerca de la relación que existe

entre las alteraciones observadas en el colon y la excesiva catarsis sugieren los AA. que la continua irritación de la mucosa colónica la mantiene sumamente edematosa, borrando el patrón normal, y que la fibrosis de los tejidos submucosos puede convertir dichas alteraciones en más o menos permanentes. La constante excitación de la musculatura puede hacer perder su tonicidad a las fibras musculares, explicando así la dilatación y la atonía observadas en los casos descritos.

Según parece, el cuadro radiográfico es a menudo interpretado erróneamente, probablemente como residuo de una antigua colitis ulcerativa. Con una historia clínica adecuada, no debería restar duda acerca del diagnóstico.

Value of Plain Film in Renal Mass Lesions (Tumors and Cysts)[1]

ALICE ETTINGER, M.D., and MILTON ELKIN, M.D.

THE INCREASING application of routine examinations of all kinds is based on the fact that many serious illnesses do not produce clinical symptoms until late in their course. Any simple screening procedure increasing our case finding of malignant lesions is therefore valuable.

Plain roentgenograms of the abdomen will give information about the presence of a mass lesion of the kidneys much more frequently than is generally appreciated. The observation that a renal mass was often an *incidental* finding in a department where many routine gallbladder and gastrointestinal studies were done drew attention to the value of a scout film of the abdomen for study of renal contours. For the full diagnostic harvest of a scout film, however, two conditions must be fulfilled: (*a*) The film must be properly exposed for upper abdominal density and (*b*) the radiologist must have formed the habit of carefully scrutinizing the renal contours in their entirety (including the medial aspect) and be aware of deviations from the normal.

The renal outline will be recognizable on a properly executed film in a high percentage of cases. Among 122 abdominal films obtained in a random group of 102 consecutive patients, the right renal outline was satisfactorily visualized in 92 (75 per cent) and the left renal outline in 79 (65 per cent). Among the 102 patients the kidney was seen in at least one of the examinatons, on the right in 80 (78 per cent) and on the left in 71 (69 per cent). Reasons for non- or poor visualization of renal contours are obliteration by fecal matter in the colon, absence of perirenal fat in very thin individuals, and obliteration of renal contours by overlying masses. If the renal contours are not visible on the available scout film, better preparation, some variation of exposure factors, or oblique films may result in their demonstration in some instances. There still remain cases, however, in which satisfactory results will not be obtained in spite of repeated attempts, unless tomography is employed.

The analysis of proved renal mass lesions to be presented here was undertaken with the idea that it might provide information as to the value of a scout film of the abdomen for their diagnosis. The series comprises tumors originating in the parenchyma and cysts. Tumors arising in the renal pelvis are not included.

Key (17) was the first to diagnose a renal tumor on a plain film of the abdomen in 1910, long before contrast studies had been introduced. Since then many authors (3–6, 8–10, 14, 15, 19, 24, 29, 31) have mentioned that a renal neoplasm may deform renal contours and that cysts are seen occasionally on plain roentgenograms. To our knowledge, however, the only data on the incidence of visibility of renal masses on scout films are those of Johnsson (16), whose main interest was to prove the value of properly performed compression urography as compared to retrograde pyelography for the diagnosis of renal neoplasms.

Our interest centered on the following questions: What percentage of renal mass lesions (*a*) could be seen on plain film, (*b*) produced only contour deformities, (*c*) produced only urographic deformities, (*d*) produced both contour and urographic deformities, (*e*) showed calcification? How many renal mass lesions were discovered because of localizing symptoms? How many renal mass lesions were discovered in patients without localizing but with constitutional symptoms? How many mass lesions were discovered incidentally?

Our material comprises 67 proved renal

[1] From the Departments of Radiology, New England Center Hospital and Tufts College Medical School, Boston, Mass. Accepted for publication in March 1953.

tumors and cysts taken from the files of our clinic, the majority of which were seen within the last decade. About 95 additional cases in which a renal mass was diagnosed, but in which operation was not performed or information concerning operation was unavailable, are not included in this study.

The technic was of uneven quality. The technically better films, by and large, were obtained within the last few years. Oblique films had not been used in earlier years and, although often helpful, were therefore not included in our analysis. Nor did we use renal contour detail as seen on urographic examination, since the slightly increased density occurring in the renal parenchyma during the passage of a contrast substance facilitates recognition of soft-tissue contours of the kidneys. Our findings are based exclusively on anteroposterior plain films. Most of the statements are based on the original x-ray reports and represent the opinion of a number of different examiners. However, where obvious errors had occurred, the cases are recorded on the basis of a critical review. In those instances which appeared to us most important, the original error has been indicated.

In our material of 67 proved renal mass lesions, 33 were malignant tumors. Of these, 29 were proved by operation and histologic examination (renal-cell carcinoma) and 4 by evidence of metastases. There were 32 renal cysts and 2 benign tumors, one a hamartoma and the other a benign papillary adenocystoma. Mass lesions manifested themselves on the plain film either by a localized bulge of the renal contour, diffuse enlargement of the renal outline, or calcification.

Twenty-six of the 33 malignant tumors, and 22 of the 32 cysts, as well as both benign tumors, were visible on plain films. This means that 50 out of 67 renal mass lesions were readily seen on the plain films, 48 because of contour changes, with or without calcification, and 2 because of calcification alone.

Seventeen mass lesions were not visualized on plain films. Of these, 8 were tumors and 9 were cysts; 8 were on the right side and 9 on the left side. Thirteen could not be seen because of defects of preparation or technic (fecal matter obscuring the renal areas or faulty exposure technic). In only 4 was failure of visualization due to inherent qualities of the mass itself, namely, its intrarenal location. Of these 4, 2 were on the right and 2 on the left side.

Of the 17 masses not seen on plain film, the size (maximum diameter), as determined by measurement on film or by the pathologist or surgeon, available in 13, was as follows:

	Right	Left
<5 cm.	3	3
5–10 cm.	4	2
>10 cm.	0	1

Interestingly enough, of the 17 masses not seen on plain film, 5 were large enough and in such a location that they could be felt on physical examination. Three were present on the right side and 2 on the left side. Four were tumors; 1 was a cyst. Thus, out of 67 mass lesions, a total of 55 could be felt or seen.

As was to be expected, roentgen visualization on plain film was highly superior to physical examination by palpation. We used the palpatory finding as recorded on admission examination for our statistics. It is probably correct that, had the cases all been seen on admission by an extremely experienced examiner, a higher percentage might have been palpated. A mass was not felt in 39 out of 67 cases (24 on the left, 15 on the right). Of these 39, 28 could be seen on plain film, 27 because of contour changes and 1 because of calcification.

Of the 39 masses not felt at examination, 11 represented malignant tumors and 1 was an adenocystoma. The remaining 27 were cysts. The size of the lesions that were not felt at physical examination was as follows:

	Right	Left
<5 cm.	3	8
5–10 cm.	8	9
>10 cm.	3	2
Unavailable	1	5

Fig. 1. S. B., a 60-year-old woman, with no symptoms. As part of a gallbladder study, a mass was seen in relation to the lower lateral pole of the right kidney. The intravenous urogram shows no appreciable deformity of the excretory system.

Their location was:

Intrarenal	5
Upper pole	15
Lower pole	10
Midrenal	3
General enlargement	1
Lateral	1
Unavailable	4

The limited value of palpation for the diagnosis of renal tumors has been stressed by Ljunggren (22).

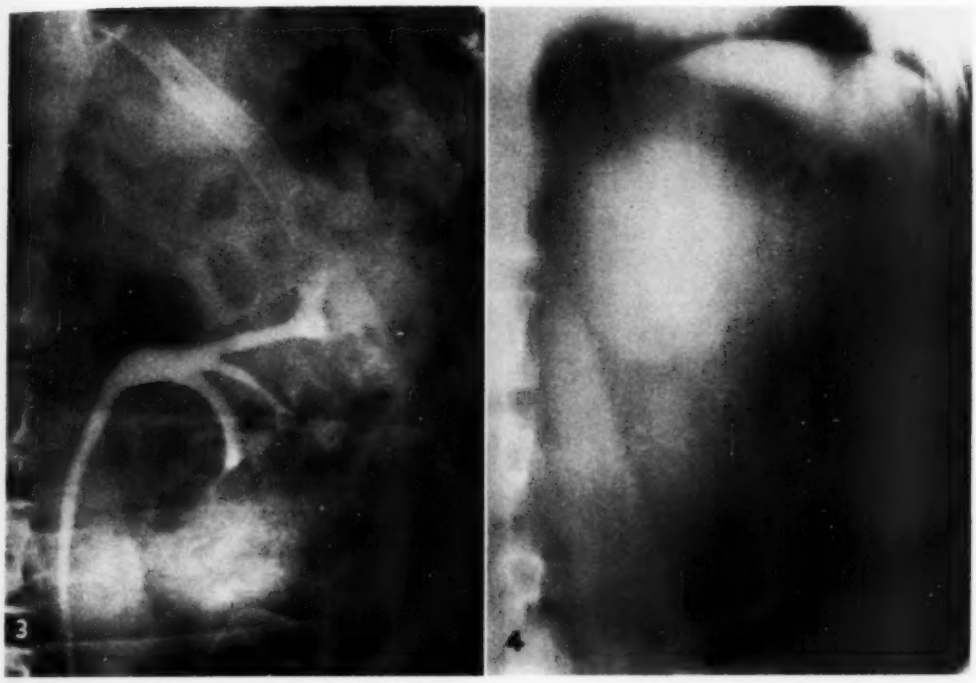
In general, an analysis of visibility of the kidneys in this series of renal masses compares well with the incidence of renal contour visibility in normal cases. In the 67 cases, the kidney or a mass replacing the renal shadow was seen in 49 (73 per cent) cases on the right and 47 (70 per cent) cases on the left side.

CONTOUR DEFORMITY WITHOUT UROGRAPHIC DEFORMITY

In our material there were 8 mass lesions in which contour deformity was the only finding. Of these, 6 were cysts and 2 were malignant tumors. The roentgenologic similarity of such masses is shown in Figures 1 and 2, Figure 1 representing an incidentally seen cyst, Figure 2 a malignant tumor. Individual reports of such cases have appeared in the literature, but it seems that mass lesions without pelvic deformity have not been recorded frequently, possibly due to the fact that renal contours were not always carefully studied in the absence of positive urographic findings (18).

Fig. 2. F. M., a 65-year-old woman with fever, weight loss, and anorexia for at least two years, but with no symptoms localized to the genitourinary tract. A mass was felt in the right flank. The plain film showed a lobulated mass in the lower pole of the right kidney. The intravenous urogram shows that this mass produces no appreciable deformity of the excretory system. Note the similarity of the radiologic findings in this case and the previous one.

Whether a renal mass will encroach upon the calices or infundibula will depend on the relation of the mass to the collecting system. A mass of given size and location in the cortex is more apt to cause a urographic deformity in a kidney with long infundibula and peripherally located cali-



Figs. 3 and 4. A. D., a 75-year-old male. The intravenous urogram (Fig. 3) shows that the superior infundibulum is displaced downward, there being an abnormally large amount of "renal parenchyma" between the renal pelvis and the superior renal outline. No circumscribed mass can be seen, however. The diagnosis was tumor or a second renal pelvis with non-functioning renal parenchyma. The tomogram (Fig. 4) demonstrates a rounded, clearly defined mass at the upper pole. This proved to be a solitary cyst.

ces than in one with short infundibula (16). In some instances, renal masses unassociated with pelvic deformities have been erroneously interpreted as extrarenal lesions (4).

Although we have not given any considerable attention, in this review, to special technics of plain film examinations, such as oblique views and tomograms, it is well worth while to illustrate with one example the value of tomography without contrast substances as a means of obtaining important information about renal masses. There are only scanty references in the literature on the value of tomography for demonstration of renal contours (5, 33).

A renal mass may appear on routine urographic studies simply as a diffuse enlargement of part of the kidney, while tomograms may reveal unexpectedly a clearly defined round lesion (Figs. 3 and 4).

UROGRAPHIC DEFORMITY WITHOUT CONTOUR DEFORMITY

In a second group of cases urographic deformity was the only evidence of a lesion and the renal contours remained normal. There are only 6 cases in this group. Of these, 1 showed calcification and could therefore be recognized without urography. Of the other 5 cases, 4 were intrarenal cysts (Fig. 5) and 1 was a malignant tumor (Fig. 6).

In the case of malignant tumor, there was actually a slight contour deformity, but this was missed when interpreting the film, and on review could not be made out except in oblique views. It appeared to be of such location and degree that it could not be defined as diagnostic of a significant abnormality.

Whether the evidence of renal pelvic deformity was obtained by urographic or

Fig. 5. H. T., a 54-year-old woman with no symptoms related to the upper urinary tract. Routine intravenous urogram shows a pressure defect upon the upper calices. No contour deformity could be seen. This proved to be an intrarenal solitary cyst. This type of cyst usually causes renal parenchymal destruction by pressure and may also bleed.

Fig. 6. I. E., a 61-year-old woman with symptoms and findings related to a carcinoma of the sigmoid with liver metastases, but no signs or symptoms pointing to the genitourinary tract. An intravenous urogram obtained as part of the diagnostic work-up revealed a compression and elongation of one of the middle calices. The shallow protuberance of the lateral border of the kidney corresponds to the pressure defect, but on the plain roentgenogram this slight contour change could not be properly evaluated. At operation the mass proved to be a renal-cell carcinoma.

pyelographic means is not essential for our consideration. Skillful intravenous compression urography as advocated by Swedish investigators (13, 25) compares favorably with pyelography in all cases where renal function is sufficiently preserved to permit its use. Since intravenous urography can be easily applied in screening procedures, it offers a greater possibility of discovering symptomless renal lesions than retrograde pyelography.

CONTOUR DEFORMITY AND UROGRAPHIC DEFORMITY

Both contour deformity and urographic deformity were present in 37 cases of the group.

CALCIFICATION

Calcification was present in a total of 9 cases—7 malignant tumors, 1 hamartoma, and 1 cyst. Seven of the calcified lesions also produced contour deformities; in 2 there were no contour changes. The type of calcification did not always permit differentiation between benign and malignant tumors. Figure 7 represents a benign hamartoma and Figure 8 a malignant hypernephroma. The roentgenologic appearance of these two lesions is very similar. Of the 2 lesions without contour changes, 1 was a cyst and the other a malignant tumor. In the latter case, calcification was the only manifestation of a mass lesion, there being no contour or urographic

Fig. 7. G. H., a 47-year-old man with no symptoms or findings except for a mass in the left flank. The scout film shows the mass in relation to the left kidney, with whorled and linear calcification suggestive of malignant tumor. This, however, proved to be a hamartoma.

deformity (Fig. 9). Because this case was picked up more or less incidentally, it is of special interest.

The usefulness of the various methods of investigation for discovery of renal mass lesions in our series is summarized in Table I.

TABLE I: SUMMARY OF X-RAY FINDINGS IN THIS SERIES

	Cyst	Tumor	Miscellaneous
Plain film unsatisfactory, pelvis deformed	6	5	0
Plain film unsatisfactory. Intravenous urogram: non-functioning. No retrograde	0	1	0
Contour change without deformity of pelvis on intravenous or retrograde pyelography	6	2	0
Contour change with deformity of pelvis on intravenous or retrograde pyelography	15	20	2 {Hamartoma / Adenocystoma
Normal contour with deformity of pelvis on intravenous or retrograde pyelography	4	1	0
Contour change. Intravenous urogram: non-functioning. No retrograde	0	2	0
Normal contour; calcification; pelvis deformed	1	0	0
Normal contour; calcification; pelvis not deformed	0	1	0
Contour change. No intravenous or retrograde pyelogram	0	1	0

CLINICAL DATA

Considered from a clinical point of view our series comprised three types of patients:

1. Patients with local findings or symptoms.
2. Patients with constitutional findings and symptoms.
3. Patients in whom a renal mass was incidentally discovered.

Hematuria, pain, and a palpable mass were considered to be localizing signs and symptoms. If any one of these or any combination of them was present, the case was included in Group 1. Twenty-eight patients had localizing signs or symptoms: 23 with malignant tumors, 1 with a benign tumor, and 4 with cysts. This analysis illustrates that the localizing signs or symptoms will not be helpful to diagnosis in the individual case, but will only direct the diagnosis on the basis of statistical probability (23).

As constitutional findings, we considered weight loss, fever, anemia, and elevated sedimentation rate. Seven patients with such findings constituted Group 2. All of these had malignant tumors. The discovery of a renal lesion in such cases will usually accomplish little for the patient beyond terminating the diagnostic search and thus saving expense. The investigation of the urological tract in patients in

Fig. 8. O. N., a 30-year-old woman with no symptoms related to the genitourinary tract. Moderate anemia and a palpable mass in the left flank. The scout film shows the mass in relation to the left kidney, with whorled and linear calcification suggestive of malignant tumor. This proved to be a hypernephroma.

whom a search for a malignant tumor is made on the basis of constitutional symptoms without localizing signs is a generally accepted routine today.

Finally, there were 22 cases in which a renal mass was discovered incidentally on plain film. Of these, 19 were cysts, 2 were malignant tumors, and 1 was a benign tumor. Ten more masses were incidentally discovered on routine intravenous urograms, 9 benign cysts and 1 malignant tumor. While in the majority of cases the preoperative diagnosis of cyst was made, the diagnosis remained one of probability rather than of certainty. The benign tumor (adenocystoma), incidentally discovered on plain film preliminary to a barium enema examination, was thought to be a cyst, but since films taken six and a half years earlier did not show the mass, a malignant tumor was also considered. The possiblity of a benign tumor was not included in the differential diagnosis. Figure 10 shows the adenocystoma as a mass at the upper pole of the right kidney. It was demonstrated to better advantage by tomography (Fig. 11).

It is generally agreed that a definite differential diagnosis between tumor and

Fig. 9. M. L., a 40-year-old man without urinary symptoms. The intravenous pyelogram discloses calcification in the left kidney without contour deformity.

cyst cannot be made on the basis of routine x-ray examinations, nor on the basis of history or clinical findings (3, 4, 7, 12, 23, 27, 29, 30, 31). It cannot be made even on the basis of observation and repeat examinations. Therefore, the incidental discovery of a mass will frequently lead to exploratory surgery unless special methods of investigation permit a definite diagnosis. The most promising methods of differential diagnosis are: puncture and contrast filling of the cyst (1, 21), aortography, and renal artery catheterization as proposed by Olsson (26). Since we did not have any personal experience with puncture of cysts or renal artery catheteri-

Figs. 10 and 11. S. B., male. Round, smoothly-outlined mass at upper pole of right kidney seen on plain film (Fig. 10). The outlines of the mass and the adjacent renal contour are more clearly shown by tomography (Fig. 11). No calcification could be demonstrated. This proved to be a papillary adenocystoma.

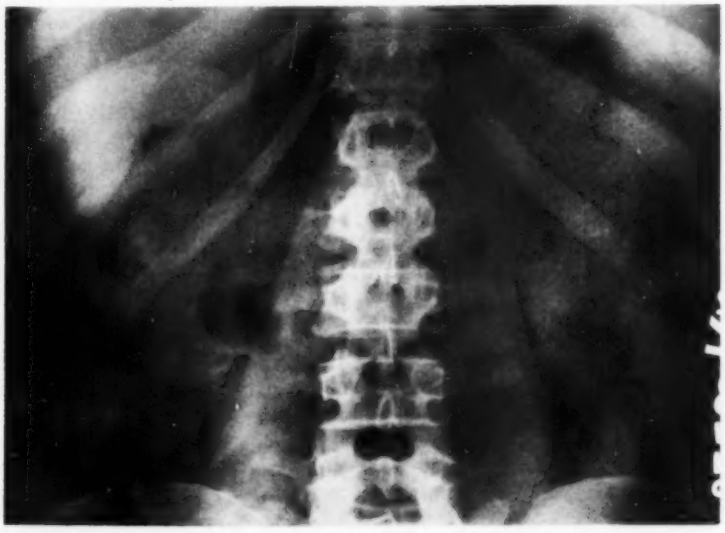
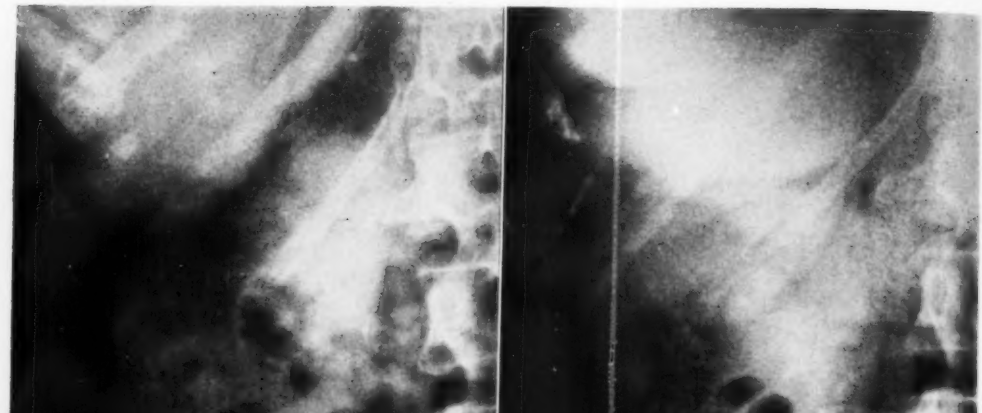


Fig. 12 H. P., a 49-year-old male without urinary complaints. The plain film obtained during the course of a gallbladder study shows a normal right renal contour but an irregular, enlarged left kidney. A pyelogram obtained four months later in an outside hospital revealed a renal neoplasm.



Figs. 13 and 14. M. T., a 58-year-old female. First admission in August 1951. Film of the lumbosacral spine done for low backache shows a normal right renal outline (Fig. 13).
Second admission, October 1952. Repeat film of the lumbosacral spine was considered normal. No attention was paid to the fact that the right renal shadow had increased in bulk since the previous examination (Fig. 14).

zation and have had insufficient experience with aortography, we cannot discuss the merits of these procedures.

It is also beyond the scope of this paper to discuss whether or not renal cysts should be removed (4, 23, 30) or left untreated if no symptoms are present (1). This decision is beyond our competence. At any rate, cysts are frequently recognized and diagnosed as mass lesions by plain film examinations.

The fact that only 2 tumors were found incidentally is disappointing in view of the high number of cysts thus discovered. The reasons, however, are obvious. First, the overall incidence of malignant renal growths is low (8, 11, 32, 34), whereas cysts are being recognized with increasing frequency (4, 20, 28). It also appears that the contour changes produced by tumors are often less obvious than those produced by cysts. The cysts are usually clearly delineated from the otherwise normal renal contour, while renal enlargement due to tumors may have a more diffuse character.

It is disappointing that we have to admit that incidental discovery of malignant tumors could have been made in 2 instances on plain films (Figs. 12–15) which came to our attention, but that 2 different examiners missed the chance to make this diagnosis. However, experience has shown that the first step toward recognition of early lesions is to have a high index of suspicion—a process of education that we have only recently experienced in the radiologic recognition of early pulmonary cancer.

CONCLUSIONS

1. Attention to renal contours on plain films will be one means of advancing diagnosis of renal masses in symptomless survey cases. There will be more cysts than tumors among these incidentally found masses, but some tumors are likely to be found also. Although the discovery of malignant lesions is, of course, more important than the discovery of cysts, the finding of cysts is nevertheless in many instances of significance, according to various authors.

2. The character of calcification does not permit the diagnosis of the exact nature of a renal mass.

3. Special attention to renal contours in lumbosacral examinations is recommended, since a dull ache in the small of the back may be the presenting symptom of a renal tumor. Anteroposterior lumbar spine examination should therefore be done without respiratory motion.

4. Urologic examinations should be carried out in all patients with constitutional symptoms of malignant disease without localizing symptoms or findings.

5. A compression device that allows one to obtain an accurate anatomical delineation of the renal pelves and ureters is of great value.

6. Attention to both, contour changes and urographic changes, is necessary when searching for renal mass lesions, since only one type of change may be present.

7. Plain films that do not demonstrate renal outlines satisfactorily should be supplemented by additional studies: oblique films, tomograms, and intravenous urograms.

New England Center Hospital
Boston 11, Mass.

Fig. 15. Same case as Figs. 13 and 14. Intravenous urogram done because of microscopic hematuria found during second hospital admission (in only one specimen and not in others) showed a mass in the upper pole of the right kidney displacing the calices laterally and inferiorly. At operation a large renal tumor was found.

REFERENCES

1. AINSWORTH, W. L., AND VEST, S. A.: Differential Diagnosis Between Renal Tumors and Cysts. J. Urol. **66:** 740–749, December 1951.

2. BRAASCH, W. F., AND EMMETT, J. L.: Clinical Urography. An Atlas and Textbook of Roentgenologic Diagnosis. Philadelphia, W. B. Saunders Co., 1951.

3. BRAASCH, W. F., AND GRIFFIN, M.: The Prognosis in Renal Carcinoma and Clinical and Pathologic Data Affecting It. J.A.M.A. **106:** 1343–1346, April 18, 1936.

4. BRAASCH, W. F., AND HENDRICK, J. A.: Renal Cysts, Simple and Otherwise. J. Urol. **51:** 1–10, January 1944.

5. BUETTI-BÄUMI, C.: Über die tomographische Leerdarstellung der Niere bei Nierentumoren. Helvet. chir. acta **15:** 131–143, May 1948.

6. BURGENER, A.: Das Pyelogram bei Nierentumoren. Betrachtungen zur Röntgendiagnose. Röntgenpraxis **9:** 98–110, February 1937.

7. DAVIS, D. M.: Diagnosis of Renal Tumors in the Adult. Radiology **54:** 639–645, May 1950.

8. DICK, V. S., AND FLINT, L. D.: Prognosis of Renal Tumors. S. Clin. North America **31:** 633–643, June 1951.

9. FARIÑAS, L., AND GÓMEZ, R. A.: Diagnóstico radiológico de los tumores del riñón. Bol. Liga contra el Cáncer **19:** 161–172, November-December 1944.

10. GILLIES, C. L.: Malignant Tumors of the Kidney in Adults. Am. J. Roentgenol. **43:** 629–635, May 1940.

11. GRIFFITHS, I. H., AND THACKRAY, A. C.: Parenchymal Carcinoma of the Kidney. Brit. J. Urol. **21:** 128–151, June 1949.

12. GUTIERREZ, R.: Large Solitary Cysts of the Kidney: Types, Differential Diagnosis and Surgical Treatment. Arch. Surg. **44:** 279–318, February 1942.

13. HELLMER, H.: On the Technique in Urography and the Roentgen Picture in Acute Renal and Ureteral Stasis. Acta radiol. **16:** 51–55, 1935.

14. HELLMER, H.: Hypernephrom als Nebenbefund bei röntgenologischen Untersuchungen der Gallenwege. Ztschr. f. Urol. **36:** 1–14, 1942.

15. HYMAN, A.: Malignant Tumors of the Kidney. Urol. & Cutan. Rev. **40:** 658–662, September 1936.

16. JOHNSSON, S.: A Contribution to the Diagnostics of Nephromata. Acta Radiol., Suppl. LX, 1946.

17. KEY, E.: Om diagnosen och kirurgiska behandlingen av maligna njurtumörer. Förhandlingarna vid Nord, kir Förenings 11 Möte, 1916. Quoted from Ljunggren (22).
18. KINDLER, K.: Zur Diagnose der Nierentumoren. Ztschr. f. Urol. **36:** 337–338, 1942.
19. KNEISE, O., AND SCHOBER, K. L.: Die Röntgenuntersuchung der Harnorgane. Leipzig, Thieme Verlag, 1941. Quoted from Buetti-Bäumi (5).
20. KUTZMAN, N., AND SAUER, H. R.: A Consideration of the Problems Presented by Unilateral Cystic Kidney Disease. J. Urol. **63:** 34–47, January 1950.
21. LINDBLOM, K.: Percutaneous Puncture of Renal Cysts and Tumors. Acta radiol. **27:** 66–72, 1946.
22. LJUNGGREN, E.: Studien über Klinik und Prognose der Gravitzschen Nierentumoren. Acta chir. Scandinav. (supp. 16) **66:** 1–363, 1930.
23. LOWSLEY, O. S., AND CURTIS, M. S.: The Surgical Aspects of Cystic Disease of the Kidney. J A.M.A. **127:** 1112–1119, April 28, 1945.
24. MELICOW, M. M.: Classification of Renal Neoplasms: A Clinical and Pathological Study Based on 199 Cases. J. Urol. **51:** 333–385, April 1944.
25. OLSSON, O.: Die Urographie bei der Nierentuberkulose. Acta radiol., Suppl. XLVII, 1943.
26. OLSSON, O.: Personal communication.
27. PIERCE, W. V.: Discussion of paper by Rieser *et al.* (30).
28. POWELL, N. B.: Surgical Emergencies Caused by Simple or Solitary Renal Cyst. J. Urol. **63:** 203–207, February 1950.
29. PRATHER, G. C.: Differential Diagnosis Between Renal Tumor and Renal Cyst. J. Urol. **64:** 193–199, August 1950.
30. RIESER, C., FORT, C. A., AND MOFFETT, J. D., JR.: Localized Intrarenal Cystic Disease of the Kidney. South. M. J. **43:** 133–138, February 1950.
31. ROLNICK, H. C., AND PRESMAN, D.: Tumors and Cysts of the Kidney. S. Clin. North America **30:** 25–42, February 1950.
32. STEINER, P. E.: An Evaluation of the Cancer Problem. Cancer Research **12:** 455–464, 1952.
33. VIRGILIO, G.: La stratigrafia renale nell'indagine radiologica dell'apparato uropoietico. Urologia **17:** 216–220, June 20, 1950.
34. United States Federal Security Agency, Public Health Service, National Office of Vital Statistics. U. S. Deaths and Crude Death Rates for Each Cause, 1946–48. Vital Statistics, Special Reports, National Summaries **35**(11): 147–60, 1950.

SUMARIO

El Valor de las Radiografías Corrientes en las Lesiones Tumefactas del Riñón (Tumores y Quistes)

Las radiografías corrientes del abdomen aportarán información acerca de las lesiones tumoriformes del riñón mucho más a menudo de lo que se piensa generalmente. Los AA., con esto presente, han repasado 67 tumores y quistes renales comprobados. Hubo 33 tumores malignos, 26 de los cuales eran visibles en la radiografía corriente; 2 tumores benignos, ambos visibles; y 32 quistes, 22 de los cuales eran visibles. En 13 casos, la falta de visualización era imputable a deficiencias técnicas, dejando 4 casos en los que propiedades inherentes en la lesión impedían descubrirla.

Formúlanse las siguientes conclusiones generales: (1) La atención prestada a los contornos renales en las radiografías corrientes constituirá un medio de mejorar el diagnóstico de las tumefacciones renales en los casos asintomáticos descubiertos en encuestas. Habrá más quistes que tumores entre esas tumefacciones descubiertas fortuitamente, pero es probable que también se encuentren algunos de los últimos. (2) La naturaleza de la calcificación no permite hacer el diagnóstico de la índole exacta de una tumefacción renal. (3) Recomiéndase que se preste atención esmerada a los contornos renales en los exámenes sacrolumbares, dado que un dolor sordo en el extremo inferior del dorso tal vez sea el síntoma manifiesto de un tumor renal. Por lo tanto, debe hacerse el examen anteroposterior de la porción lumbar del raquis sin movimientos respiratorios. (4) Deben verificarse exámenes urológicos en todo enfermo que tenga síntomas constitucionales de afección maligna sin síntomas o hallazgos localizadores. (5) Un artefacto compresor que permite obtener una delineación anatómica exacta de las pelvis renales y los uréteres resulta de mucho valor. (6) Al buscar lesiones tumefactas del riñón, es necesario prestar atención tanto a las alteraciones de los contornos como a las urográficas, pues quizás no exita más que una forma de alteración. (7) Las radiografías corrientes que no revelan satisfactoriamente los contornos renales deben ser complementadas con otros estudios: radiografías oblicuas, tomogramas e urogramas intervenosos.

Dissolution of the Intervertebral Disk in the Aged Normal

The Phantom Nucleus Pulposus[1]

J. GERSHON-COHEN, M.D., HARALD SCHRAER, PH.D., DAVID M. SKLAROFF, M.D., and NATHAN BLUMBERG, M.D.

DISORGANIZATION of the intervertebral disk occurs in association with other degenerative changes, but the peculiar "vacuum-like" spaces in the roentgenogram, which are seen as globules in the area of the nucleus or as dispersed radiolucent streaks in the intervertebral space, are not generally given particular attention as a phase of such degenerative processes. We have described these changes previously as the "phantom nucleus pulposus" (1), and Magnusson (4) and Knutsson (3) have referred to them as intervertebral vacuum phenomena. The condition is one in which there is a loss of nuclear substance without tissue or fluid replacement, leading to the appearance of the empty space or "vacuum" easily recognized in the roentgenogram. More attention to its incidence and character might possibly lead to a better understanding of desiccating tendencies in aging tissues. This report is concerned with these changes as they appeared in a group of 130 aged normals.

METHOD AND RESULTS

Bone survey examinations were made of residents of the Home for the Jewish Aged in Philadelphia, including anteroposterior and lateral roentgenograms of the spine. All subjects were healthy enough to be ambulatory. Though many had various degenerative changes, these were neither disabling nor in need of medical attention. A comprehensive orthopedic examination was part of the clinical study in each instance. The group included 82 females and 48 males. The age range was from sixty-seven to ninety-three years; the mean age of the men was eighty-two and a half years, and of the women seventy-one years.

Fig. 1. Multiple vacuum phenomena in lower lumbar spine.

Vacuum phenomena were found in 27 of the 130 spines which were studied, occurring in 19 of the 82 females and in 8 of the 48 males. A positive history of chronic low backache was obtained in only 7 cases; in the remaining 20 there had never been any complaints referable to the spine. The orthopedic studies did not reveal a greater incidence of spinal column immobility in the group in which vacuum phenomena were observed than in the remaining controls.

In only 8 cases was the vacuum phenomenon limited to one interspace; in each of the remaining 19 cases, vacuum streaks were found in two to six intervertebral spaces (Fig. 1). When a single phantom nucleus was found, it occurred usually in the lumbar spine, either in the first, fourth, or fifth interspace; it was never observed in the second or third interspace in this small group of 8 cases (2 males and 6 fe-

[1] From the Albert Einstein Medical Center, Northern Division and the Home for the Jewish Aged, Philadelphia, Penna. Accepted for publication in March 1953.

Fig. 2. Isolated phantom nucleus pulposus with no visible secondary degenerative changes.

TABLE I: THE INCIDENCE OF PHANTOM NUCLEUS PULPOSUS IN A GROUP OF 130 NORMAL AGED

Case No.	Age	Sex		Location	
				Dorsal	Lumbar
10	76	M			4, 5
22	71		F	12	
26	78		F	9, 10, 11, 12	3
33	82	M			1, 2, 3, 4
35	83	M			1, 3, 4
42	93	M			1
49	67		F		5
50	75		F	5, 6, 12	2
52	83		F		2, 4, 5
54	93	M		3, 5, 7, 8	2, 3
61	73		F	9, 10, 11, 12	1
64	67		F	9, 10	2
72	71		F	8, 9, 10	3
82	79		F	8	3, 4
84	70		F		1
89	78		F	6, 7	
91	73	M			2, 4
92	77	M			4
95	70		F		4
96	81		F	6, 8, 9	1, 5
100	70		F		5
103	74		F	12	5
111	81		F		4
115	79		F		1, 2
119	78		F		2, 3, 4
123	70		F	10, 11	
129	83	M		10, 11	

males). Among the patients with multiple nuclear phantoms, the lumbar spine alone was involved in 7 (4 males and 3 females), the dorsal spine in 3, and the dorso-lumbar spine in 9. Seldom was the upper portion of the dorsal spine involved, the phantom nucleus being found usually in the lower seven interspaces. No phantom nucleus was found in the cervical spine. (Table I)

There was wide variation in the appearance of these intervertebral vacuum phenomena. In some cases, the vacuum was sharply localized to the area corresponding to the gelatinous nucleus pulposus itself

Fig. 3. Posterior spondylolisthesis with anteriorly placed vacuum phenomenon.

(Fig. 2); in other instances, the boundaries of the irregular vacuum streaks extended beyond the confines of the nucleus, traversing the fibers of the annulus fibrosus. These extra-nuclear extensions of the vacuum usually occurred anteriorly and were associated with kyphosis. The rare posterior extensions were associated with lordotic disalignment. When the vacuum spaces were found in the localized narrow anterior portion of the joint, posterior spondylolisthesis often occurred (Fig. 3).

Spondylolisthesis was associated with 8 phantom nuclei, and in 6 of these the upper vertebral body was displaced *posteriorly* as in Figure 3. In one case the displacement was posterolateral. In all cases of combined spondylolisthesis and phantom nucleus pulposus, there was marked localized narrowing of the intervertebral space in the region of the vacuum phenomena. Also always present were secondary hypertrophic degenerative changes; yet in no instance was there complaint of pain.

Among these 130 subjects, x-ray studies

of the spine revealed an incidence of hypertrophic degenerative changes in 92 per cent. All of the 27 persons with phantom nuclei had moderately advanced hypertrophic changes with one exception, a seventy-year-old female in whom a centrally placed vacuum was seen between L-5 and S-1, a joint otherwise healthy in

Fig. 4. Moderate subchondral sclerosis, narrowing of interspace, and anterior spondylolisthesis with phantom nucleus pulposus.

appearance (Fig. 2). No correlation seemed to exist between the degree of arthrosis and the number of phantom nuclei.

The intervertebral spaces were always narrowed in the presence of the vacuum phenomena. This narrowing varied in extent and uniformity. When it was limited to a portion of the joint space, disalignment of the spine was found, accounting for the prevalence of kyphoscoliosis. The narrowing of the joint space was marked in only 3 cases; otherwise it was minimal or moderate in degree. Subchondral sclerosis bordering the phantom nucleus also was usually minimal or moderate (Fig. 4); seldom was it pronounced. Almost all spines revealed the presence of osteophytes bordering the involved joint. These osteophytes varied in size and shape, rarely attaining massive proportions. Seldom did they form ankylosing bony bridges across the joint.

The joint surfaces on either side of the phantom nucleus pulposus usually were uneven, and the contour of the joint surfaces followed no pattern. In 8 cases herniation of the nucleus pulposus into one or both adjacent vertebral bodies was found in conjunction with the vacuum phenomenon (Fig. 5).

Fig. 5. Phantom nucleus pulposus associated with herniation into adjacent vertebral bodies.

Vertebral body fractures occurred in 25 per cent of the 130 cases studied. Among those revealing phantom nuclei, 18 per cent showed associated fractures. This difference may not be significant, but it was noted that none of the fractures involved the vertebral bodies bordering a phantom nucleus.

Kyphoscoliosis of the spine was associated with the finding of the phantom nucleus pulposus in all cases but one. The uneven narrowness of the joint space in such cases was probably an important factor in this disalignment. The incidence of malalignment encountered in the remaining controls of the whole group reached 85 per cent; and the disalignment generally was limited to kyphosis of the upper dorsal spine, rarely complicated by scoliosis.

DISCUSSION

The presence of vacuum phenomena in cases of spondylitis deformans was noted by Knutsson and Magnusson. Among the possible explanations for this phenomenon, the drying out of the disk substance, either

as a degenerative change following trauma or as a "normal" aging process, strikes us as the best. The diminution in body stature which takes place during the last third of life is said to be due, among other reasons, to the drying and thinning of the intervertebral cartilages. Aging tissue is said to lose its capacity for retaining water, accounting for the 5 to 6 pound weight loss of the body during the seventh decade (5). The upper dorsal kyphosis so commonly seen in the aged of this group might be the result of these drying-out processes in the spine, with the accompanying relaxation of the paraspinal musculature.

When the atrophy was limited to the osseous system, codfish deformity of the vertebral bodies was seen and this was compensated by swelling of the intervertebral disks. Diminution in stature was less pronounced in these cases than in those exhibiting vacuum phenomena with thinning of the intervertebral disks. If desiccation and shriveling do occur in the nucleus and in the fibers of the annulus fibrosus, the resulting radiolucent spaces, comprising the "vacuum phenomena," appear because there is no synovial fluid to fill them up. These explanations cannot be applied so readily to the occurrence of the vacuum phenomena during adolescent osteochondrosis as observed by Knutsson. Another question not yet answered is whether these adolescent findings persist into old age, since in a few of our cases evidence was found of healed osteochondrosis and old herniations of the nucleus pulposus into the vertebral bodies.

Knutsson also observed vacuum phenomena in the adolescent before the appearance of osteochondrosis, but with the exception of a single case, we did not find these phenomena in the aged in the absence of other degenerative changes.

While the spines exhibiting vacuum phenomena were found to show no greater restriction of mobility than the others, the use of functional x-ray studies instead of clinical orthopedic examinations might have revealed some differences (2).

Contrary to Magnusson's conclusion, we believe that clinical awareness of the phantom nucleus pulposus is important, since laboratory experimentation may follow and lead to a better understanding of an aging process which may be preventable if not reversible.

SUMMARY

Dissolution of the intervertebral disks, with the appearance of a "phantom nucleus pulposus" or "vacuum phenomenon", was found in 27 of 130 aged normal individuals. Usually more than one intervertebral space was involved, as many as six joints being implicated in a single case. A history of injury and chronic backache was obtained in only one-third of the subjects. Minimal to moderately advanced hypertrophic degenerative changes were found in practically all cases. The involved joints were narrowed irregularly. Subchondral sclerosis and unevenness of the joint surfaces bordering the phantom nucleus were always present.

Kyphoscoliosis occurred in practically all cases in which intervertebral vacuum streaks were seen in the x-ray film; yet subjects with these changes had no greater limitation of motion than the remainder of the aged normal population.

The general tendency to desiccation in aging tissues is presumed to be the basis for the appearance of these "vacuum phenomena," but whether this need be regarded as an irreversible pathologic process rather than a preventable physiologic disturbance is a challenging question.

255 South 17th St.
Philadelphia 3, Penna.

REFERENCES

1. GERSHON-COHEN, J.: The Phantom Nucleus Pulposus. Am. J. Roentgenol. **56:** 43–48, July 1946.

2. HASNER, E., SCHALIMTZEK, M., AND SNORRASON, E.: Roentgenologic Examination of the Function of the Lumbar Spine. Acta radiol. **37:** 141–149, 1952.

3. KNUTSSON, F.: The Vacuum Phenomenon in the Intervertebral Discs. Acta radiol. **23:** 173–179, 1942.

4. MAGNUSSON, W.: Über die Bedingungen des Hervortretens der wirklichen Gelenkspalte auf dem Röntgenbilde. Acta radiol. **18:** 733–741, 1937.

5. VISCHER, A. L.: Old Age. Its Compensation and Rewards. London, Allen & Unwin, Ltd., 1947, pp. 24–25.

SUMARIO

Disolución del Disco Intervertebral en Sujetos Normales de Edad Avanzada. El Nucleo Pulposo Fantasma

En 27 de 130 individuos normales de edad avanzada observóse disolución del disco intervertebral con aparición de un "núcleo pulposo fantasma" o "fenómeno del vacío." Por lo general, estaba afectado más de un espacio intervertebral, hallándose atacadas hasta seis articulaciones en un solo caso. No se obtuvo historia de lesión y raquialgia crónica más que en la tercera parte de los sujetos. En casi todos los casos descubriéronse alteraciones degenerativas hipertróficas que variaban de mínimas a moderadamente avanzadas. Las articulaciones afectadas mostraban estrechamiento irregular. Había siempre esclerosis subcondral y desigualdad de las superficies articulares que colindaban con el núcleo fantasma. Existía cifoscoliosis en casi todos los casos en que se observaron en la radiografía estrías intervertebrales del vacío; sin embargo, los sujetos que tenían esas alteraciones no padecían de mayor limitación de los movimientos que el resto de la población normal de edad provecta.

Supónese que la tendencia general a la desecación en los tejidos en vías de envejecimiento constituye la base para la aparición de esos "fenómenos del vacío," pero el problema aun sin solución es si hay que considerar la misma como proceso patológico irreversible más bien que como trastorno fisiológico prevenible.

A Mechanism of the Production of Pseudofractures in Osteomalacia (Milkman's Syndrome)[1]

HOWARD L. STEINBACH, M.D., FELIX O. KOLB, M.D., and RUTHERFORD GILFILLAN, M.D.

Osteomalacia is a metabolic disease of bone in which there is a deficient mineralization of the bony matrix. The amount of matrix present is normal or slightly increased. The defective deposition of calcium salts is due to the lowered concentration of calcium or phosphorus, or both, in the body fluids, as a result either of impaired absorption from the gastrointestinal tract or increased renal excretion. Because of their decreased mineral content, the bones are weakened, becoming soft and bending readily. Deformities of the extremities, pelvis, vertebrae, and skull may occur. As a result of the weakening of the bones, the osteoblasts are stimulated to lay down new bone matrix and elaborate alkaline phosphatase, which is usually present in abnormal concentration in the blood serum (1).

In some cases of osteomalacia, multiple, almost symmetrical, radiolucent bands of diminished density, resembling fractures, occur in the cortex of the bone. These pseudofractures are seen most frequently in the axillary border of the scapula, the ribs, the pubic rami, the medial aspect of the neck of the femur, the iliac bones, and the radii and ulnae. They were first described by Milkman and have come to be known as "Milkman's syndrome" (7, 8). Milkman did not realize that the pseudofractures in his patient were due to osteomalacia, but a review of his case and of similar cases, by Albright (1), indicates that the classical syndrome of Milkman is invariably associated with a primary osteomalacia. In some instances pseudofractures are apparent on roentgenograms before there has been sufficient generalized demineralization of the skeleton to be determined by the ordinary roentgen examination.

There have been many differences of opinion as to the actual mechanism of the production of pseudofractures in osteomalacia. Camp and McCullough (3), in an excellent review of the literature before 1941, concluded that pseudofractures were always associated with conditions that weaken the bones or that produce unusual strains to which the bones are not adapted. They believed that those bones which were subjected to the greatest mechanical stresses were the ones most frequently involved. According to these writers, pseudofractures occurred in many diseases other than osteomalacia, such as early and late osteogenesis imperfecta, fragilitas ossium, hyperparathyroidism, hyperthyroidism, Paget's disease, adrenal-pituitary bone dystrophy, severe chronic acidosis or hyperglycemia, congenital syphilis, osteomyelitis, osteopetrosis, states of overloading of bone, and certain blood dyscrasias. We disagree with Camp and McCullough and agree with Albright in his assertion that the radiolucent bands found in the diseases mentioned are not the same as those present in Milkman's syndrome. It is true that in these diseases there are occasionally shadows resembling the radiolucent bands found in Milkman's syndrome, but they differ in the following respects: they usually are not bilaterally symmetrical; there are no definite sites of predilection; they heal rapidly without therapeutic measures to increase the body stores of calcium and phosphorus; and they usually are present in areas of localized bone disease or as a result of trauma.

Looser (5, 6) studied these lesions histologically in cases of osteomalacia and rickets, and concluded that they represented infractions in the bone caused by abnormal stresses and strains, which pro-

[1] From the University of California School of Medicine, San Francisco, California, Department of Radiology (H.L.S.), Metabolic Unit and Department of Medicine (F.O.K.), and Department of Surgery (R.G.). Accepted for publication in March 1953.

duced many small cracks in the cortex. The summation of these breaks produced the defect which was visible on the roentgenogram. Callus was laid down, but did not calcify for the same reason that the skeleton had a decreased calcium content.

These theories of unusual muscular stress, however, fail to explain many of the characteristic features of Milkman's disease, such as the almost symmetrical distribution and the sites of predilection for these lesions. Many of the radiolucent bands occur in regions, such as the axillary border of the scapula, that are not subjected to unusual stress. LeMay and Blunt (4) advanced a theory that would account for all of these bizarre features. They dissected three cadavers and found blood vessels in close proximity to bone in the areas where pseudofractures frequently occurred. They postulated that the mechanical stress caused by the vessels may result in small breaks in the cortex and subsequent laying down of callus, which is uncalcified in osteomalacia.

We are presenting a case of severe osteomalacia with Milkman's syndrome due to pancreatic insufficiency, in which it is

Fig. 1 Roentgenogram (A) and diagram (B) of the right shoulder. Pseudofracture at the base of the acromion process of the scapula. A healed fracture of the clavicle at the junction of its middle and distal thirds is present. The bones of the shoulder, as well as the other parts of the skeleton, are demineralized.

Right Left

Fig. 2. Roentgenograms (A) and diagrams (B) of the right and left forearms. Bilateral, almost symmetrical, pseudofractures of the ulna are present.

Fig. 3. Right hand. In addition to the generalized demineralization, there are defects in the distal phalanges of the second and fourth fingers, the head of the second metacarpal bone, and the distal end of the radius. These are not pseudofractures.

shown conclusively by arteriographic studies that a definite relationship of arteries to typical pseudofractures exists. This leads us to believe that the pseudofractures are the result of erosion of the softened cortex by adjacent blood vessels. This case was also unusual in that there were several localized areas of radiolucency in the bones, which were demonstrated roentgenographically. The clinical aspects will be discussed in another publication.

REPORT OF CASE

A 62-year-old white female entered the University of California Hospital on Aug. 5, 1952, with a history of progressive backache. A kyphoscoliosis had developed in early childhood, which the patient attributed to excessive piano playing. She was not incapacitated by this and had a normal pregnancy at the age of twenty-three. Two years before admission she began to have pains in her back, radiating anteriorly. She also had some pain in her right hip, aggravated by walking. Injections of cortisone for

Fig. 4. Right tibia, with a large saucer-shaped defect in the anterior aspect.

about three months had caused an improvement in appetite but did not alleviate the pain. In October 1951, the patient entered the San Francisco Hospital, where she was on bed rest for about nine months, with a diagnosis of anemia, which was treated with iron. Her stools were positive for occult blood and contained excessive fat. Roentgenograms revealed several rib fractures, a generalized demineralization of the skeleton, and a hiatus hernia. Laboratory studies indicated a low blood calcium and phosphorus and elevated alkaline phosphatase. The patient

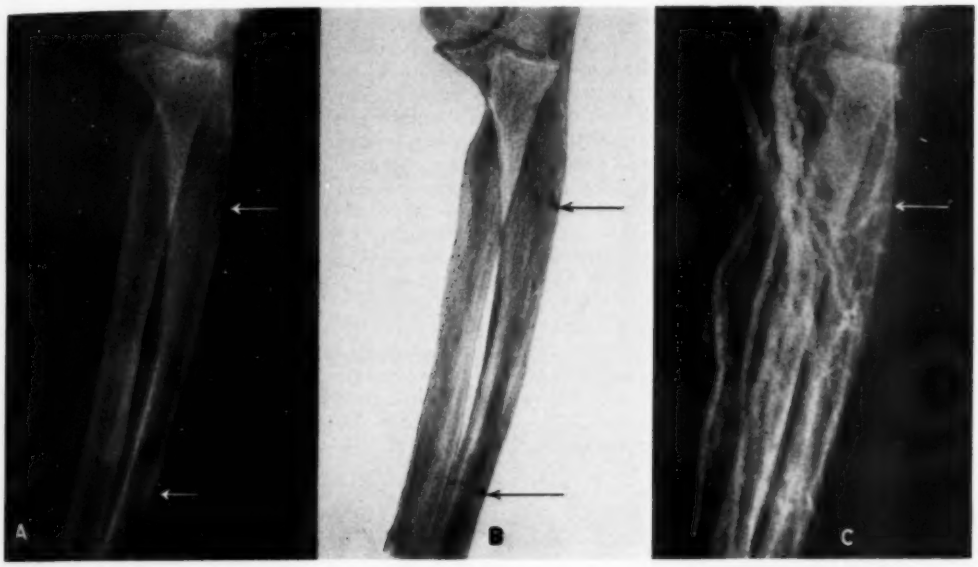


Fig. 5. A and B. Roentgenogram and diagram of left forearm. C. Left brachial arteriogram. This examination was not conclusive, but there is a vessel that corresponds in position and direction with the cortical defect on the posterior surface of the ulna as demonstrated on the plain roentgenogram (A), which was obtained in the same projection.

was then transferred to the Hospital of the Laguna Honda Home (San Francisco's Old People's Home), where her case was reviewed and a diagnosis of osteomalacia with Milkman's syndrome was established. She was referred to the University of California Hospital for further diagnostic studies and treatment.

The past history was irrelevant except for contusion of the right anterior tibial region with subsequent hematoma formation about nine years before.

Physical examination showed a small, thin lady in moderate distress, unable to move about freely. Her temperature was 37° C.; pulse 88; respiratory rate 24; blood pressure 218/110 mm. Hg. The important findings were: tongue coated and papillated; chest markedly deformed, with a dorsal kyphoscoliosis; rib cage unduly springy, with tenderness along the ribs in the left axillary line; distal end of the right clavicle deformed; heart enlarged, with a Grade 2 systolic precordial murmur. There was some tenderness in the region of the costovertebral angles and swelling of the interphalangeal joints of the hands. External hemorrhoids were present.

Laboratory Findings: Serum calcium 8.5 mg./100 c.c., phosphorus 3.0 mg./100 c.c., alkaline phosphatase 78 Bodansky units, protein 6.5 gm./100 c.c., albumin 4.0 gm./100 c.c., chlorides 100 mEq/liter, carbon dioxide 22.6 mEq/liter, sodium 138 mEq/liter, potassium 3.3 mEq/liter, N.P.N. 33 mg./100 c.c.; P.S.P. 30 per cent in half an hour, total 60 per cent. Sulkowitch tests were consistently negative. The 24-hour urine contained 20 mg. of calcium. Glucose tolerance tests showed fasting blood sugar to be 121 mg./100 c.c.; the half hour figure was 210, one hour 337, two hours 269. Plasma carotene was 0. Stool fat 72 hours: wt. 341.8 gm., quant. 3.4 per cent wet wt., 17 per cent of dry weight; total fat: 11.6 gm. total wet wt. Vitamin A tolerance, starch tolerance, and gelatin tolerance tests were all borderline. Prothrombin 100 per cent; hemoglobin 12.0 gm./100 c.c.; red cells 4.6 million/c.mm.; white cells 5,850/c.mm. The urine contained a trace of albumin, and the culture was positive for *B. coli*.

The roentgen report of a skeletal survey on Aug. 5, 1952, was as follows: "There is a marked generalized decalcification of the entire skeleton. In addition, there are numerous cortical defects which in some instances are almost bilaterally symmetrical. These are particularly prominent in the distal thirds of the clavicles, bases of the acromion processes of the scapulae (Fig. 1), posterior and lateral surfaces of the ulnae (Fig. 2), and the superior and inferior pubic rami (Fig. 6A). There are also numerous areas of bone destruction of various sizes which are quite unusual. These are present in the inferior ramus of the pubis on the left side, the head of the right second metacarpal bone, the distal phalanges of the right second and fourth fingers (Fig. 3), the middle phalanx of the left second finger, the distal phalanx of the left fifth finger and the anterior aspect of the right tibia. The lesion in the tibia is very extensive and presents a saucer-like defect in the proximal third. The soft tissues of this extremity are atrophied (Fig. 4).

"The entire spine has a marked scoliosis, and there is a defect in the pedicle of the fourth lumbar vertebra, which allows it to protrude quite a distance in front of the third vertebral body. Some bony bridging is present between these two vertebrae.

"*Impression:* This patient presents unmistakable evidence of osteomalacia with Milkman's syndrome. In addition, there is another disease process which has caused multiple destructive lesions of the skeleton."

Additional roentgen findings were listed as follows:

"Hiatus hernia.

"Reverse spondylolisthesis of the 4th lumbar vertebra.

"Tomograms of the epigastrium revealed multiple calcifications within the body and tail of the pancreas.

"A small bowel study showed a normal small bowel pattern.

"The lamina dura was not visible on dental roentgenograms."

A biopsy of the lesion of the right tibia was interpreted by Doctor Jackson Crane. It showed grossly soft, spongy bone which on section revealed numerous irregular trabeculae of osteoid tissue and new bone. These trabeculae were bordered by a single layer of large polyhedral cells of the osteoblast type. In addition, there were occasional large multinucleated cells, the nuclei of which resemble those of osteoclasts. The spaces between the trabeculae were occupied by a rather cellular fibrous connective tissue containing a few of the multinucleated cells described above. Frequent small thin-walled blood vessels were also present.

Sections of the border of the lesion including harder, more normal bone revealed more clearly calcified and ossified trabeculae but with other changes similar to those described above. Here again osteoblasts were very numerous. Still other areas showed even more normal appearing bone trabeculae.

Diagnosis: Osteomalacia, advanced (tibial biopsy).

Treatment: On Aug. 23, 1952, the patient was started on calcium lactate powder, 10 gm. per day; vitamin D (Condol), 50,000 units per day; high-carbohydrate, low-fat, low-protein and high-calcium diet; multivitamin tablets; and pancreatin, 3.0 gm. t.i.d. On this regimen, the urinary calcium had become weakly positive by Sept. 8, 1952. In addition, calcium chloride was given in doses of 6 gm. per day, starting on Sept. 17, 1952. The patient also received gantrisin, penicillin, and aureomycin for the urinary tract infection, which cleared up.

A skeletal survey on Sept. 30, 1952, demonstrated "a marked repair of the localized osseous lesions and pseudofractures. A considerable decalcification of the entire skeleton was still present, but this was less than on the previous examination."

Special arteriographic studies were performed. Brachial arteriograms of the left arm were not completely satisfactory, but on the lateral views there was suggestive evidence that small vessels crossed the ulna in the region of the cortical bands (Fig. 5).

A right retrograde femoral arteriogram demonstrated well the proximal portion of the femoral artery, the external iliac artery, and their branches. There was a fairly large branch arising from the medial aspect of the external iliac which was somewhat tortuous, but which eventually assumed a vertical course precisely over the region in which a large pseudofracture of the superior ramus of the pubis was present. This vessel was identified as an aberrant obturator artery arising from the external iliac and passing immediately behind the superior ramus of the pubis (Fig. 6).

Progress: There was marked and rapid improvement of the patient's general outlook, bone pain, and mobility. Her serum calcium level had risen to 10.9 mg./100 c.c., phosphorus to 4.3 mg./100 c.c., and urinary calcium to 100 mg./24 hr. The alkaline phosphatase, however, remained high (42 Bodansky units). She was discharged to a convalescent home on Oct. 9, 1952, greatly improved. Laboratory reports on Dec. 19, 1952, showed a return of all the chemical values to normal. Roentgenograms revealed a change in all of the bony defects, which had now become more dense than the surrounding skeletal structures.

DISCUSSION

We have demonstrated in this case that the radiolucent band in the superior ramus of the pubis corresponds in situation and direction with the course of a large artery. The patient had received therapy and there had been some recalcification of the lesion, but on the films the radiolucent band was still visible, superimposed upon the shadow of the opacified vessel. Stereoscopically, it could be seen that the vessel passed immediately behind the superior ramus of the pubis This vessel was identified as an abnormal obturator artery, arising from the external iliac artery instead of the hypogastric artery. Various authors describe the obturator as arising in from 13 per cent to 28 per cent of cases from the inferior epigastric or the external iliac; in this case it descends almost vertically to the upper part of the obturator foramen (3). The diagram (Fig. 7) demonstrates its proximity to the pubis.

Small vessels were also demonstrated on the brachial arteriogram, immediately adjacent to the radiolucent bands in the

Fig. 6. A. Pelvis, showing pseudofractures of the pubic bones. B. A right retrograde femoral arteriogram demonstrating the proximal portion of the femoral artery, the external iliac artery, and their branches. There was a fairly large branch arising from the medial aspect of the external iliac, which was somewhat tortuous but eventually assumed a vertical course precisely over the region in which the pseudofracture was present. This vessel is an aberrant obturator artery arising from the external iliac and passing immediately behind the superior ramus of the pubis.

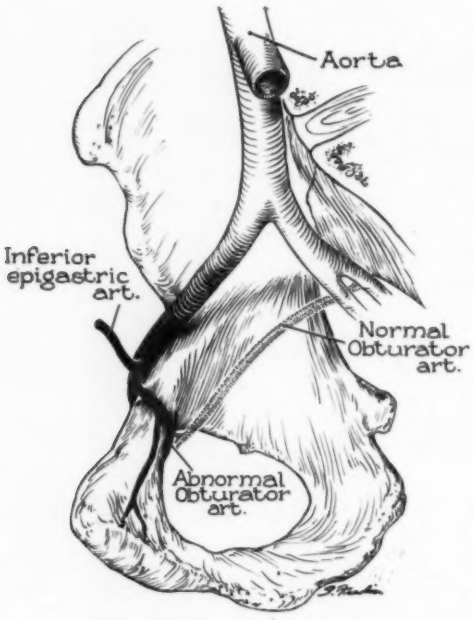


Fig. 7. Drawing showing the proximity of the abnormal obturator artery to the posterior surface of the pubis. The vessel wraps around the posterior surface of the superior ramus of the pubis and passes through the obturator foramen.

proximal part of the ulna. The pulsating vessels probably cause localized erosions of the cortex in the softened bone. This produces grooves which become filled with uncalcified osteoid, because of the low concentration of calcium and phosphorus in the body fluids. The cortical band in the pubis of this case is wider than the opaque shadow demonstrated on the arteriogram. This is so because the vessel is considerably wider than its lumen, and also because there is some lateral movement of the vessel with pulsation. With adequate therapy, the mineral content of the skeleton increases and calcium salts are deposited in the callus. As the bone becomes strengthened, it is resistant to erosion by the vessels and the cortical lesions become imperceptible.

This explanation for the mechanism of the production of pseudofractures in osteomalacia accounts for the constant, frequently symmetrical, localization of the lesions, their persistence for long periods of time in untreated patients, and their width and smooth margins. In some instances, true fractures may occur in the regions of the cortical grooves because of the weakening of the bone.

SUMMARY

A case of proved osteomalacia with bilateral, almost symmetrical, pseudofractures is presented.

Arteriographic studies indicated the presence of arteries in close proximity to some of the pseudofractures. This suggests that the cortical defects are produced by erosion of the softened cortex by the pulsating vessels.

University of California Medical Center
San Franciso 22, Calif.

REFERENCES

1. ALBRIGHT, F., ET AL.: Osteomalacia and Late Rickets; Various Etiologies Met in United States with Emphasis on That Resulting From Specific Form of Renal Acidosis, Therapeutic Indications For Each Etiological Subgroup, and Relationship Between Osteomalacia and Milkman's Syndrome. Medicine **25**: 399–479, December 1946.

2. CAMP, JOHN D., AND MCCULLOUGH, J. A. L.: Pseudofractures in Diseases Affecting the Skeletal System. Radiology **36**: 651–663, June 1941.

3. GRAY, H.: Anatomy of the Human Body. Philadelphia, Lea & Febiger, 24th Ed., 1942, p. 618.

4. LEMAY, M., AND BLUNT, J. W., JR.: A Factor Determining the Location of Pseudofractures in Osteomalacia. J. Clin. Investigation **28**: 521–525, May 1949.

5. LOOSER, E.: Über pathologische Formen von Infraktionen und Callusbildungen bei Rachitis und Osteomalakie und anderen Knochenerkrankungen. Zentrabl. f. Chir. **47**: 1470–1474, 1920.

6. LOOSER, E.: Über Spätrachitis und Osteomalakie. Klinische, röntgenologische und pathologischanatomische Untersuchungen. Deutsche Ztschr. f. Chir. **152**: 210–357, 1920.

7. MILKMAN, L. A.: Pseudofractures (Hunger Osteopathy, Late Rickets, Osteomalacia). Am. J. Roentgenol. **24**: 29–37, July 1930.

8. MILKMAN, L. A.: Multiple Spontaneous Idiopathic Symmetrical Fractures. Am. J. Roentgenol. **32**: 622–634, November 1934.

SUMARIO

Un Mecanismo de la Producción de Seudofracturas en la Osteomalacia (Síndrome de Milkman)

Ha habido muchas discrepancias de opinion acerca del mecanismo de las seudofracturas en la osteomalacia. Preséntase ahora un caso que demuestra la existencia de una relación bien definida de las arterias con las típicas seudofracturas. Esto conduce a la conclusión de que las seudofracturas, representadas en la radiografía como franjas radiolucientes de menor densidad, son consecuencia de la erosión de la corteza reblandecida por los vasos pulsátiles. Con una terapéutica adecuada, el contenido mineral del hueso aumenta y se depositan sales de calcio en la callosidad. A medida que se fortalece el hueso, se vuelve más resistente al desgaste producido por los vasos y las lesiones corticales se vuelven imperceptibles.

Osteomyelitis of the Spine Following Prostatic Surgery[1]

EDWARD DE FEO, M.D.

VERTEBRAL osteomyelitis following prostatectomy has been described previously, but little mention of the condition is made in the radiological literature. Although a rare complication of prostatic surgery, osteomyelitis of the spine is a debilitating condition in the early diagnosis of which the radiologist may be of aid if he is alert to its possibility. Among a large number of radiologists questioned personally, however, none could recall having seen a single case. To previously reported cases, the following examples of osteomyelitis following prostatic surgery are added.

CASE I: E. B., a 70-year-old male, was admitted to the hospital with a ten-year history of progressive frequency and difficulty in urinating. Urinalysis revealed 2 white cells and uric acid crystals. The red blood cell count was 3,700,000, hemoglobin 13.4 gm., white blood cell count 10,800, with a normal differential. A first-stage suprapubic prostatectomy was performed on Oct. 22, 1950. The bladder was found to be hypertrophied and the prostate bulged at the base. A mushroom catheter was left in place. A second-stage suprapubic prostatectomy was performed on Oct. 30. The prostate was freed from its bed and removed, and a Pilcher bag was inserted for hemostasis. On microscopic examination, glandular and interstitial hyperplasia, chronic inflammation, and obliterative endarteritis were found. The patient experienced a chill on the first postoperative day, accompanied by an elevation of temperature to 103° F., with a return to normal the following day. After an uneventful recovery, he was discharged on Nov. 4. He was readmitted for a few hours on Dec. 1 and given 500 c.c. of whole blood. Laboratory studies revealed 4,300,000 red blood cells and 14,500 white cells.

The patient was admitted for the third time on Dec. 11. At this time he complained of excruciating pain of one week duration, "coming in waves" in the lumbar area. There was marked tenderness, with muscle spasm and rigidity at the left costovertebral angle. An x-ray examination of the lumbar spine made upon admission was negative. Spinal fluid study revealed clear fluid, pressure of 160 mm. of water, total protein 45 mg. per cent. The urine contained 20 to 30 white cells and bacteria.

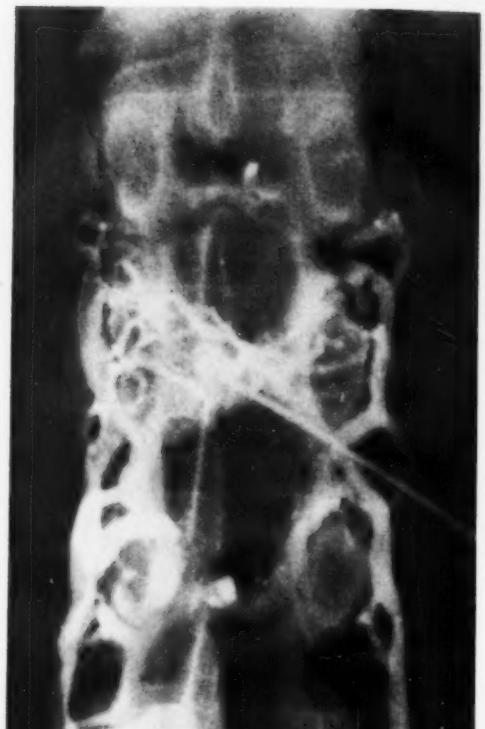


Fig. 1. An unintentional demonstration of the complexity of the vertebral system made during an attempt at abdominal aortography.

The white cell count was 11,300, with a normal differential, sedimentation rate 60 and index 50, acid phosphatase 1.5 units. Temperature on admission was 101° F., becoming normal on the next day and remaining so thereafter.

The patient received penicillin, 1,600,000 units intramuscularly per day for forty-five days, with a one week interruption after the first month. Aureomycin, 1,500 mg., was given for fourteen days. Demerol, 100 mg., was given whenever necessary, and 10 mg. of morphine sulfate every six hours for twelve days, with no relief initially. Two cubic centimeters of 2 per cent novocaine was injected by lumbar puncture on admission, and 1,000 c.c. of 1 per cent procaine in normal saline was adminis-

[1] From St. Clare's Hospital, Schenectady, N. Y. Accepted for publication in April 1953.

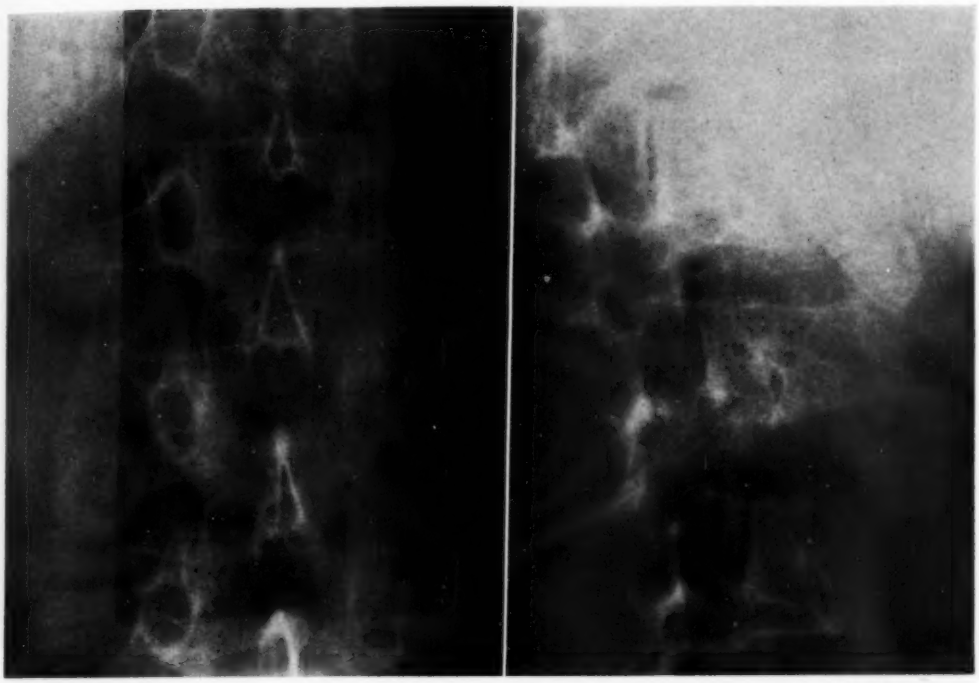


Fig. 2. Case I. Roentgen examination of the spine made through a body cast seven weeks following onset of back symptoms. Destruction of the second lumbar vertebral body at the inferior margin (on the left and anterior) and a similar pattern of destruction of the opposing portion of the third lumbar body.

tered intravenously three days later. On Dec. 20, a body cast was applied following a subarachnoid block, and only then did the patient begin to experience relief of pain.

Roentgenograms of the lumbar spine on Dec. 26 were again negative. Examination five weeks following admission, Jan. 15, 1951, revealed destruction of the superior cortical margin of L-2 at its anterior aspect. On Jan. 22 there was revealed increase in bone destruction in this zone, with a similar pattern of destruction in the opposing portion of L-3 and minimal decrease in the intervertebral space. Evidence of bone regeneration was noted as early as two weeks later.

The patient was discharged from the hospital symptom-free sixty days following admission. He has been without complaint in the two-year period following discharge.

CASE II: M. Z., a 59-year-old male, was admitted to the hospital because of increasing urinary difficulty, nocturia, and frequency for two years. On June 4, 1952, suprapubic prostatectomy was performed and 35 grams of tissue were removed. The pathological report was "hypertrophy, interstitial hyperplasia, and marked chronic inflammation." Urine examination at that time was normal. The patient was discharged in five days, after an uneventful period, without elevation of temperature or complaints.

Ten days prior to the second admission, on June 22, sharp pain occurred in the right chest. The pain then moved to the left side at the level of the 4th and 5th ribs, radiated to both shoulders, and was aggravated by deep respiration. Chest x-ray examination revealed bilateral minimal pleural reaction and minimal disk atelectasis. Hematologic findings and temperature were normal. The patient received 800,000 units of penicillin per day and morphine sulfate for severe pain in the chest. During his hospital stay he complained of gas pains and upper abdominal distention for five days, finally relieved by enema and removal of a large amount of feces and flatus. He was discharged on July 1.

The pain continued and the patient was again hospitalized for a chest examination, which revealed larger areas of disk atelectasis, and a gastrointestinal series, which was negative except for hypomotility. Hematology and temperature were again normal.

The final admission was on July 24 (fifty days postoperative), when in addition to chest pain, the patient experienced severe upper back pain, malaise, and depression. The pain was in the region of D-10 and at the level of the 6th and 7th ribs at the midaxillary line. Roentgenograms of the thoracic spine revealed destruction of the intervertebral disk

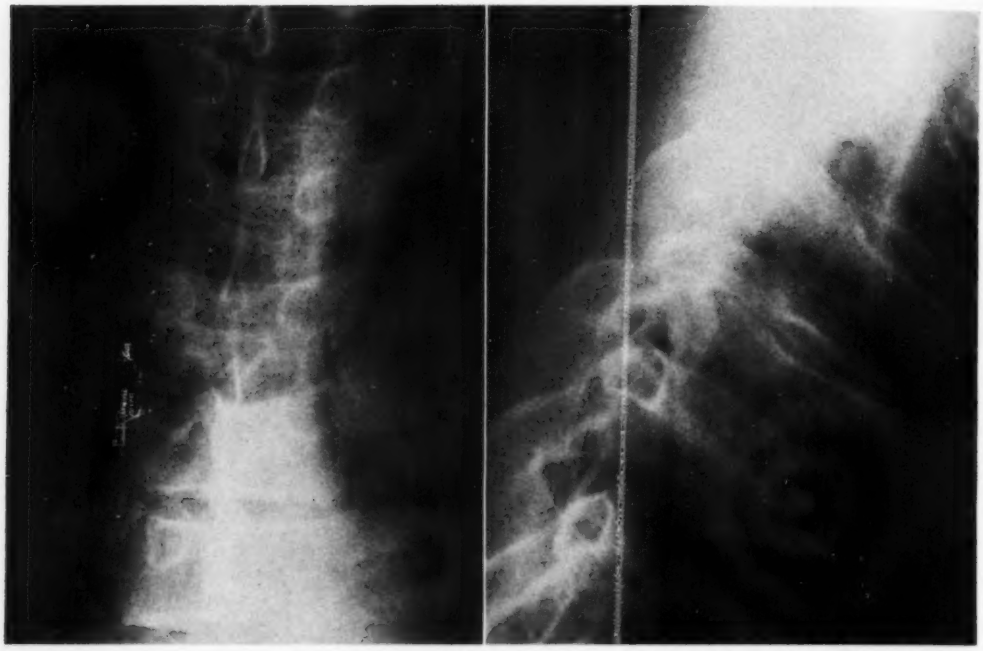


Fig. 3. Case II. Opposing areas of destruction of the bodies of D-6 and D-7, with complete obliteration of the intervertebral space.

between D-6 and D-7 and of the opposing portions of the vertebral bodies, chiefly on the right and anterior. Review of earlier films showed the beginning of this process. The red blood cell count was 4,500,000, white blood cell count 8,000. The urine contained a moderate number of pus cells. Head traction with ten pounds of weight was applied ten days later. The patient was given 400,000 units of penicillin per day and 1 gm. of streptomycin for fourteen days, followed by terramycin for four days. During his stay he experienced more gas pains and severe back pain for almost three weeks, with relief after traction application. He was completely free of pain when discharged on Aug.16, and has had no difficulty since that time.

The association of vertebral body osteomyelitis with urinary tract infection has long been recognized (4). One author (7), in 1925, in contrast to present belief, expressed the opinion that the osseous disease preceded the urinary tract infection. It remained for Batson's research (2, 3) to demonstrate a pathway for spread of vertebral column infection. He injected radiopaque water-color material and thorium dioxide into the dorsal vein of the penis in cadavers and animals, and noted that the usual course was through the prostatic plexus of veins, along the vessels of the lateral pelvic wall into the common iliac vein on either side and into the inferior vena cava. With abdominal pressure, however, the material soon passed into the vertebral system and finally entered the cranial cavity. From these studies, it was concluded that the vertebral vein system is ordinarily valveless, composed of very thin-walled vessels, difficult to identify but of considerable capacity. The vessels are found in the epidural fat tissues as well as in muscles and in the vertebral bones themselves. The system is in communication with the veins of the thoraco-abdominal cavities at each intervertebral space, communicating indirectly with the inferior vena cava, pelvic viscera, intercostal veins, the azygos system, and occasionally with the renal vein. The pressure in the vertebral network is very low and does not come under pressure changes of the body cavities, but with compression of the abdomen, straining, coughing, the Valsalva maneuver, etc., the intra-

abdominal pressure is increased and blood flows into the vertebral veins. Direction of flow here is not constant, being up or down the spine or to or from the cavities. With such a system, it is not difficult to realize how infection could spread with ease from the prostatic bed.

Surgical interference with the prostatic bed creates an excellent opportunity for infection to occur and to spread to the spine. Nevertheless, relatively few cases are reported. Deming and Zaff (5) described 3 cases in 1942, Donahue (6) reported 2 cases in 1949, and Adlerman and Duff (1) mention 1 case, all of which followed prostatectomy. These cases plus the 2 recorded here are reviewed below.

DISCUSSION AND REVIEW

None of the patients in this series revealed any evidence of urinary tract infection prior to operation. Three had slight leukocytosis. In the period of one to eight days following prostatic surgery, 6 had elevations of temperature above 103° F., usually accompanied by chills. In 3 cases, blood examination with culture studies showed hemolytic Streptococcus, non-hemolytic Streptococcus, and Proteus vulgaris. During the same period 3 patients had a marked leukocytosis, ranging as high as 43,000.

Two patients of the series experienced chest pain prior to any pain in the back, leading to an erroneous diagnosis of pleurisy. The condition is most commonly confused, however, with metastatic cancer. The back pain with osteomyelitis is almost always excruciating and usually much more agonizing than that due to metastasis and is greatly aggravated by the least change of position. Physical examination reveals usually slight local tenderness, muscle spasm or rigidity, and occasionally minimal local swelling. Excluding Deming's case in which the pain occurred three years after operation, the average time for appearance of symptoms was twenty-seven days, ranging from five to fifty days. Urinalysis during this period revealed a moderate number of white cells in 3 cases and was normal in others. Slight leukocytosis was present in only 2 cases, and 1 patient had a temperature elevation reaching 101° F. In the remaining cases the temperature was normal. Batson's demonstration of filling of the vertebral plexus with pressure in the abdomen would suggest that abdominal distention, hiccough, abdominal binders, cough, and straining are to be avoided, if possible, since these conditions may increase the opportunity for bacterial contaminants to enter the vertebral system and to infect the spine. It is interesting to observe that abdominal distention and hiccough were noted in 4 cases preceding the occurrence of back symptoms. Gastrointestinal series performed prior to the onset of back symptoms revealed hypomotility in two instances.

In all cases narcotics and sedation provided little if any relief of severe localized pains. In those in whom the diagnosis was established, immobilization, usually with a plaster jacket, afforded the most satisfactory relief almost immediately. In earlier cases not diagnosed initially, months of hospitalization were required, while in later cases provided with immobilization and antibiotic therapy the patients were able to leave the hospital after several weeks.

ROENTGEN FINDINGS

Omitting Deming's third case, the average time of roentgen findings was nine weeks following operation and seven weeks following the onset of back symptoms. The range for all cases was from two weeks to three years. In 2 cases bone findings were missed initially and discovered on subsequent review of earlier films. Lesions were in the lumbar area in 3; lower thoracic area in 3; and in the cervical spine in 1. All but 1 patient had early—and usually severe—disk destruction. Also, all but 1 patient had irregular destruction of adjacent cortical plates of vertebral bodies, with later increasing subcortical destruction and minimal sclerosis. In 2 cases destruction was initially

noted in one body only for a short period of time. Destruction was predominantly anterior and predominantly unilateral. In only 1 instance was there any lamina or pedicle involvement. A paravertebral mass was noted but once.

Estimation of the average time required for significant degree of healing cannot be determined because of the great variation in the intervals of follow-up examination. Bone regeneration was noted as early as two weeks following the first appearance of bone destruction. Regeneration of osseous tissue of the vertebral bodies is accompanied by minimal sclerosis, lipping and bridging of adjacent vertebrae. Some cases revealed later wedging and fusion of vertebrae and kyphosis deformity. Whenever disk degeneration was present, intervertebral space narrowing persisted to the same degree or greater. In the 1 case with a paravertebral mass there was no change in the appearance of the mass after a three-year interval.

SUMMARY

1. Two new cases of osteomyelitis of the spine following prostatectomy are presented and 6 others from the literature, are reviewed.

2. Although rare, the condition is a serious complication of prostatic surgery, and the radiologist should be aware of its occurrence.

3. None of the patients had evidence of urinary tract infection prior to surgery, but in the immediate postoperative period nearly all had marked temperature elevation, 3 had leukocytosis, and half had abdominal distention before the appearance of back symptoms.

4. Back symptoms appeared at an average of four weeks following surgery, at which time there was no temperature elevation or leukocytosis and only minimal local signs. The pain was invariably severe, aggravated by any motion and not relieved by narcotics. Immobilization afforded prompt relief.

5. The average time required for the appearance of bone changes on the roentgenogram was nine weeks following surgery. The most common area of involvement was the lower thoracic and upper lumbar spine. In all but 1 case there was persistent disk destruction. The site of destruction of the vertebral bodies was predominantly anterior and unilateral. With one exception all patients had destruction of opposing portions of adjacent vertebral bodies.

St. Clare's Hospital
Schenectady, N. Y.

REFERENCES

1. ADLERMAN, E. J., AND DUFF, J.: Osteomyelitis of Cervical Vertebras as a Complication of Urinary Tract Disease. J.A.M.A. **148:** 283–285, Jan. 26, 1952.

2. BATSON, O. V.: The Vertebral Vein System as a Mechanism for the Spread of Metastases. Am. J. Roentgenol. **48:** 715–718, December 1942.

3. BATSON, O. V.: Function of the Vertebral Veins and Their Role in Spread of Metastases. Ann. Surg. **112:** 138–149, July 1940.

4. CARSON, H. W.: Acute Osteomyelitis of the Spine. Brit. J. Surg. **18:** 400–408, January 1931.

5. DEMING, C. L., AND ZAFF, F.: Metastatic Vertebral Osteomyelitis Complicating Prostatic Surgery. Tr. Am. A. Genito-Urin. Surgeons (1942) **35:** 287–305, 1943.

6. DONAHUE, C. D.: Osteitis of the Spine. J. Urol. **61:** 405–409, February 1949.

7. GOLDSCHMIDT, L. B.: Osteomyelitis from a Urological Standpoint. South African M. Rec. **23:**167–168, April 25, 1925.

SUMARIO

Osteomielitis Raquídea Consecutiva a Cirugía Prostática

La osteomielitis del raquis es una complicación grave de la cirugía prostática y, aunque rara, tiene que tomarla en cuenta el radiólogo. Preséntanse 2 casos y se repasan además 6 otros tomados de la literatura.

En ninguno de los 8 enfermos había signos de infección del aparato urinario antes de la operación, pero en el período postoperatorio inmediato casi todos mostraron hipertermia acentuada, 3 revelaron leucocitosis y la mitad tuvieron distensión abdominal antes de aparecer síntomas imputables al dorso.

Aparecieron síntomas dorsales en un promedio de cuatro semanas después de la

operación, para cuya fecha no había elevación térmica ni leucocitosis y sólo mínimos signos locales. El dolor fué invariablemente intenso, sin aliviarse más que con la inmovilización.

El tiempo requerido para la aparición de alteraciones óseas observables roentgenológicamente promedió nueve semanas desde la operación. La zona más común de invasión fué en las porciones dorsal inferior y lumbar superior del raquis. En todos los casos, menos uno, hubo persistente destrucción de los discos. El sitio de destrucción de los cuerpos vertebrales fué predominantemente anterior y unilateral. Con una excepción, en todos los pacientes hubo invasión de las porciones opuestas de los cuerpos vertebrales adyacentes.

Osteitis Ischii and Pubis Following Abdominoperineal Resection for Carcinoma of the Rectum

Case Report[1]

ALEXANDER LEWITAN, M.D., and LOUIS NATHANSON, M.D.

LEUCUTIA, who reviewed the literature of osteitis pubis up to June 1950, listed 116 authenticated cases and added 4 of his own. In some of the earlier reports on osteitis pubis, frank osteomyelitis of the pelvis had been erroneously included. Among all the cases reviewed by Leucutia, only one, that of Abrams, Sedlezky, and Stearns, followed abdominoperineal resection for carcinoma of the rectum. Because of the rarity of this complication of rectal resection for carcinoma, we are reporting the following case. It is of interest, also, in that radiation therapy effected a complete cure.

The clinical importance of osteitis pubis lies mainly in its correct differentiation from metastatic cancer, since it offers an entirely different prognosis, being self-limited.

CASE REPORT

H. K., a 42-year-old male, was admitted to the Jewish Sanitarium and Hospital for Chronic Diseases on Jan. 22, 1952. He had diabetes of five years duration, which had been controlled by diet, with the addition of insulin in 1951. In 1949 he had undergone a hemorrhoidectomy. One year later, Nov. 12, 1950, he was admitted to a local hospital with a history of practically continuous diarrhea and lower abdominal pain since the operation. Inspection of the rectum disclosed small internal hemorrhoids. A gastrointestinal series at that time led to a clinical diagnosis of diverticulitis (Nov. 22, 1950). No barium enema study was done.

Another physician was consulted and a second gastrointestinal series was followed by complete obstruction. The patient was then admitted to a different local hospital, where a cecostomy was performed on May 21, 1951. The obstruction was found to be due to a lesion within the rectum, which proved on biopsy to be an adenocarcinoma, Grade 2.

An abdominoperineal resection was done on June 12. Findings were as follows: "carcinoma of the rectosigmoid; no evidence of remote metastases; some swollen nodes in the mesocolon but not characteristically malignant."

The postoperative course was uneventful. The cecostomy was closed on June 30, and the patient was discharged on July 30 with a permanent colostomy. Following surgery he felt weak and did not return to work until December.

During the month of December, the patient had slight pains in his legs, which became disabling when he attempted to work. The pain started on the left side and was less severe on the right. After roentgenographic studies of the pelvis, a private physician made a diagnosis of metastatic carcinoma. There was no elevation of temperature or pulse at any time.

On admission to the Jewish Sanitarium and Hospital for Chronic Diseases, the patient had severe pain in the inguinal region, groin, and hips, which prevented him from walking or sitting and required large doses of opiates for relief. There was, however, good power in the lower extremities. The reflexes were intact. Temperature was normal. Blood pressure was 120/70; pulse 84. The blood study appeared to be normal, though eosinophils were high, ranging from 3 to 6 per cent in weekly counts. The sedimentation rate was 9. The findings on urinalysis varied between normal and slight traces of sugar. The Wassermann reaction was negative.

Medication consisted of 10 units of insulin daily, large amounts of Demerol every four hours, and chloral hydrate. A course of radiation therapy was given from Jan. 31 to Feb. 25, with 100 r per treatment for a total of 600 r to each of two ports, one anterior and one posterior. The following factors were employed: 200 kv., 1.0 mm. Cu and 1.0 mm. Al filtration. The ports measured 10 × 20 cm. and the target-skin distance was 50 cm. The reproductive organs were shielded with lead. The ports were placed eccentrically at first, to include the entire left ischial tuberosity.

As soon as the intensity of the pain subsided, opiates were reduced and finally eliminated. At the completion of the radiation treatments, the patient was ambulatory and was sent home, though he complained of some residual pain on walking. On March 26, 1952, he returned because of pain in the right leg and received supplementary therapy as an out-patient. The same ports were used,

[1] From the Radiological Section of the Jewish Sanitarium and Hospital for Chronic Diseases, Brooklyn, N. Y. Accepted for publication in April 1953.

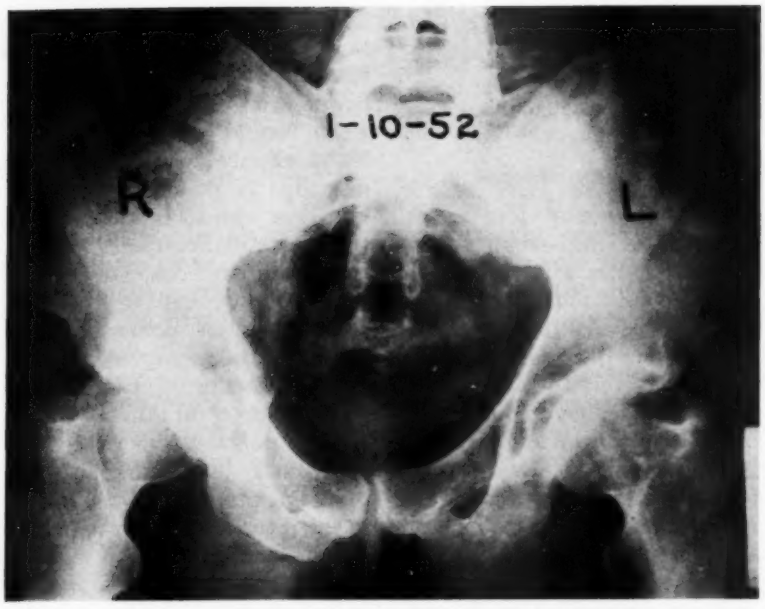


Fig. 1. Roentgenogram of the pelvis twelve days before hospital admission, showing marked periosteal fraying and roughening of the ischial turberosity on the left. There is minimal fraying of the ischial tuberosity on the right.

Fig. 2. Roentgenogram obtained one year after the onset of symptoms, showing separation of the symphysis pubis, pronounced sclerosis of the margins, and dense deposits in both ischial tuberosities. The patient is fully ambulatory.

being directed more toward the right side. The additional course consisted of a total of 300 r per port. At this time 75 r was given twice a week. There has been no further therapy, and the patient has been able to resume his usual duties as a driver of a beer truck, working six to eight hours daily.

DISCUSSION

This case is noteworthy for several reasons. The onset of the disabling symptoms occurred six months after the major surgical procedure of abdominoperineal resection, and they reached their peak four weeks later, at the time of admission to this hospital. Usually osteitis pubis starts earlier. Osteomyelitis offered no difficulty in the differential diagnosis. There was no fever, leukocytosis, or other clinical sign of infection, no suppuration of any kind, and no roentgenographic evidence of sequestration. Metastatic cancer had also to be excluded. There was no clinical evidence of recurrence. Lymph node deposits had been absent at the time of operation, and the roentgen findings were not suggestive. Periosteal involvement was the predominant radiographic feature. There was evidence of contralateral involvement of the pubic space. These features, in conjunction with the absence of metastatic foci throughout the skeletal system, were all against metastatic cancer. The relief of pain following irradiation was dramatic and unequivocal. This was purely an effect of irradiation, since no medication was used aside from opiates and insulin. The roentgen dosage was grossly inadequate for a metastatic lesion secondary to a rectal carcinoma. Futhermore, metastasis to bone from adenocarcinoma of the rectum is exceedingly rare, whereas prostatic metastases are common.

In this patient we believe the differential diagnosis was more conclusive than usual. The clinical picture was that of an osteitis pubis with a predominance of pain in the ischial tuberosities. Films which were obtained in 1950, at the time of the gastrointestinal series, showed a normal symphysis pubis and normal ischial tuberosities, which established the absence of pre-existing disease of these structures.

It is conceivable that, in the course of radical surgery such as abdominoperineal resection for carcinoma of the rectum, ligation of some vessels is carried out which would partially interfere with the blood supply to the pubic bones. The diagnosis of diabetes mellitus in our patient has also to be taken into consideration, since diabetes will predispose to vascular complications, infections, or aseptic necrosis. We believe that milder cases of osteitis pubis occur following this type of surgery but escape detection because of lack of roentgen examinations and the self-limitation of the disease. Whether osteitis pubis in our case started at the pubic arch and secondarily affected the ischial tuberosities or actually proceeded in the reverse fashion is open to conjecture. At the onset there was minimal involvement of the symphysis with pronounced osteoperiostitis of the ischial tuberosity on the left. Subsequently marked separation of the symphysis occurred, and both ischial tuberosities were involved. The intervening bony structures of the pubis and ischium, however, appeared to be free of involvement, which suggests that the disease process proceeded primarily along the periosteum to certain sites of predilection.

SUMMARY

A case of osteitis ischii and pubis with onset six months after abdominoperineal resection for carcinoma of the rectum is reported, in a forty-two-year-old diabetic male. There was complete regression of symptoms following radiation therapy. The importance of this clinical entity lies in its correct differentiation from metastatic cancer and its more favorable prognosis.

405 Clinton Ave.
Brooklyn 5, N. Y.

REFERENCES

ABRAMS, M., SEDLEZKY, I., AND STEARNS, D. B.: Osteitis Pubis. New England J. Med. **240:** 637–641, April 21, 1949.

BEER, E.: Periostitis of Symphysis and Descending Rami of Pubes Following Suprapubic Operations. Internat. J. Med. & Surg. **37:** 224–225, 1924.

KLINEFELTER, E. W.: Osteitis Pubis. Review of the Literature and Report of a Case. Am. J. Roentgenol. **63:** 368–371, March 1950.

LEUCUTIA, T.: Osteitis Pubis and Its Treatment by Roentgen Irradiation. Am. J. Roentgenol. **66:** 385–404, September 1951.

WHEELER, W. K.: Periostitis Pubis Following Suprapubic Cystostomy. J. Urol. **45:** 467–475, March 1941.

SUMARIO

Osteítis del Isquión y del Pubis Consecutiva a Resección Abdominal por Carcinoma del Recto. Presentación de un Caso

Comunícase un caso de osteítis del isquión y del pubis que tuvo su iniciación a los seis meses de una resección abdominal por carcinoma del recto. El enfermo era un varón de 42 años de edad, con historia de cinco años de diabetes. Los síntomas desaparecieron completamente a continuación de la roentgenoterapia.

La importancia de esta entidad clínica estriba en su diferenciación de las metástasis cancerosas. En el caso descrito, la diferenciación resultó fácil. No había signos clínicos de recurrencia de la lesión primitiva. No existía invasión de los ganglios linfáticos al ejecutarse la operación y los hallazgos roentgenológicos no sugerían cáncer. No se descubrieron metástasis en el sistema óseo, y los síntomas respondieron favorablemente a una dosis de irradiación que hubiera sido absolutamente inadecuada para una lesión metastática secundaria a carcinoma rectal.

Progressive Exophthalmos Following Thyroidectomy Cured by Irradiation of the Cerebral Centers[1]

A Case Report

DR. A. TEVFIK BERKMAN

Istanbul, Turkey

THE PATHOGENESIS and treatment of exophthalmos in association with hyperthyroidism are problems as yet unsolved. Although there undoubtedly exists a relationship with the activity of the thyroid, treatment of the hyperfunctioning gland is frequently without effect on the exophthalmos. Indeed, in only about a third of the cases is there an improvement in the protrusion of the eyes following surgical, medical, or radiation therapy of the primary disease, while in some cases the course is actually progressive, and this, in spite of the fact that in 80 to 90 per cent of cases other symptoms of hyperthyroidism disappear with suppression of the activity of the gland.

Irradiation of the hypophysis for Basedow's disease dates back to 1925 (7, 9), but observations of its effect on exophthalmos are relatively few. Borak (3), in 1935, reporting favorably on pituitary irradiation in toxic goiter, mentioned correction of exophthalmos in some instances. More recently the procedure has been tried by others with varying results. The earlier literature is reviewed by Ginsburg (6) and Mandeville (8). Beierwaltes (1), in 1951, obtained significant recession of exophthalmos in 7 of 10 patients in whom the pituitary was irradiated. Fossati and Silvestrini (4) directed irradiation to temporal and frontal fields in 6 patients, obtaining excellent results in 2, good in 2, and no effect in 2.

In the case to be reported here a progressive exophthalmos unaffected by surgical extirpation of the thyroid showed prompt regression following irradiation of the cerebral centers.

CASE REPORT

M. I., a 26-year-old male, was referred to the author in 1951, because of headache, tremor of the hands, and a far advanced exophthalmos with an associated conjunctivitis. He had undergone thyroidectomy two and one half years earlier (May 16, 1949) for exophthalmic goiter. Definite improvement of symptoms of thyroid origin was obtained but sympathetic disturbances—protrusion of the eyes and tremor—had persisted, becoming even more marked than before operation.

Preoperative History: When seen in May 1949, the patient complained of anorexia, weight loss, abdominal pain, and diarrhea. He gave a history of a meningeal syndrome in infancy—said to have been cured by laxatives—tuberculous adenitis, and pleurisy on two occasions. He had been in the hospital fourteen months prior to this admission because of an earlier tuberculous infection and fever of 38° C. During the period of hospitalization (fifteen days), a rapid pulse and progressive weight loss were observed. Two months later there was still a marked tachycardia, and slight protrusion of the eyes was first noticed. Since the thyroid showed some enlargement, a diagnosis of toxic goiter was made and the patient was treated with iodine for one year. This was without effect. The exophthalmos and goiter increased, sepsis and high fever developed, and the basal metabolism rate showed a steady increase, +28 to +38 to +58.

On physical examination at this time the patient appeared well developed and active, with shiny, protruding eyes His temperature was 38.5° C., pulse rate 130 per minute. Routine studies of the chest, gastrointestinal tract, and genitourinary system showed no abnormalities. A tremor was present and the patient was described as "jerky." The thyroid gland was tender to palpation and of elastic consistency. Both lobes were enlarged and showed various arborizations.

Operation: Thyroidectomy was performed on May 16, 1949, and the sutures were removed seven days later.

Subsequent Study: Upon being referred to the author, the patient showed a pronounced bilateral exophthalmos (Figs. 1 and 2), a severe tremor, and a pulse rate of 96 to 102 per minute. He complained of insomnia and abdominal pain and diarrhea. There was a slight polyuria, but microscopic study of the urine was within normal limits. The signs of Stellwag, Graefe, and Moebius were positive. The eyes were moist as a result of photophobia. Frenantol-H365 (LaRoche-Navarron), which was recommended by Besançon of Paris, was without

[1] Accepted for publication in January 1953.

Figs. 1 and 2. Severe exophthalmos, progressive, following thyroidectomy for toxic goiter (Oct. 5, 1951).

Figs. 3 and 4. The same patient, Dec. 25, 1951, showing marked improvement following irradiation of the pituitary.

effect, and irradiation of the pituitary was undertaken. Three portals were used, two temporal and one frontal, measuring 4 × 4 cm. each. The irradiation factors were 200 kv.p., 15 ma., 2.0 mm. Cu plus 1.0 mm. Al filtration, 1.8 mm. Cu h.v.l. The focus-skin distance was 50 cm. and the dose was 800 r per portal in forty-nine days, each portal being treated once a week.

Marked improvement was obvious at completion of the series, and a month later one could claim a definite cure (Figs. 3 and 4). There was a weight gain of 6 kg., insomnia was no longer troublesome, all symptoms related to the sympathetic disturbance disappeared, and the patient was able to lead a normal life.

DISCUSSION

Exophthalmos constitutes a special problem within the complex syndrome of Basedow's or Graves' disease. It is important not only because of its effect upon the appearance of the patient but because of the keratitis which may develop as a result of the inability to close the eye. Surgical and medical measures have been disappointing. Thiouracil has proved ineffective, and it is generally accepted that radioiodine is not indicated. Irradiation of

the pituitary appears to be the most logical form of treatment for progressive exophthalmos following thyroidectomy in view of the fact that there has been postulated for the gland an exophthalmos-stimulating hormone as well as a thyrotropic hormone (Friedgood, 5).

The case reported here furnishes additional evidence in favor of this latter procedure. As pointed out above, the symptoms of sympathetic origin—tremor, exophthalmos, abdominal pain, etc.—which failed to regress following ablation of the thyroid promptly disappeared following irradiation directed to the cerebral centers. Small portals, 4 × 4 cm., outlined with great care, and a dosage three or four times that usually employed for functional irradiation were used. The rapid correction of the exophthalmos is to be explained by the action of the radiation in producing diminution of the retrobulbar mesenchymal reaction, such as cell proliferation, edema, and lymph stasis. So prompt a regression of the degenerated muscles could hardly be expected. The alleviation of the other sympathetic symptoms is presumably due to a re-establishment of the synergy between the hypophysis and the subthalamic region.

Beutel (2) found a parallelism between the blood cholesterol level in Basedow's disease and the clinical symptoms. Since it is known that the adrenal cortex has a cholesterogenic effect, one may consider the possibility of irradiation of the adrenals for hyperthyroidism or even for exophthalmos resistant to pituitary irradiation.

SUMMARY

A case of severe exophthalmos showing continuous progression two and a half years after thyroidectomy was treated by irradiation of the hypophyseal-hypothalamic region. The exophthalmos promptly diminished and other symptoms of sympathetic origin disappeared. The possible mechanism of the action of pituitary irradiation in bringing about regression of exophthalmos is discussed.

Universite Radiologi Enstitü ve Klinigi
Istanbul, Turkey

REFERENCES

1. BEIERWALTES, W. H.: Irradiation of the Pituitary in the Treatment of Malignant Exophthalmos. J. Clin. Endocrinol **11:** 512–530, May 1951.

2. BEUTEL, A.: Der Blutcholesterinspiegel als Indikator der strahlentherapeutischen Beeinflussung der Hyperthyreosen. Strahlentherapie **69:** 400–406, 1941.

3. BORAK, J.: Die Behandlung von Hyperthyreosen durch Röntgenbestrahlung der Hypophyse. Strahlentherapie **53:** 73–89, 1935. Also, in English, in Radiology **24:** 535–549, May 1935.

4. FOSSATI, F., AND SILVESTRINI, F.: La roentgenterapie dell'esoftalma tireotropico. Radiol. med. **37:** 609–621, August 1951.

5. FRIEDGOOD, H. B.: Clinical Applications of Studies in Experimentally Induced Exophthalmos Following Subtotal Thyroidectomy. J. Clin. Endocrinol. **1:** 804–812, October 1941.

6. GINSBURG, S.: Postoperative Progressive Exophthalmos with Low Basal Metabolic Rate. Ann. Int. Med. **13:** 424–450, September 1939.

7. HOLZKNECHT, G.: Über die Röntgentherapie der Basedowschen Krankheit. Strahlentherapie **30:** 605–612, 1928.

8. MANDEVILLE, F. B.: Roentgen Therapy of Orbital-Pituitary Portals for Progressive Exophthalmos Following Subtotal Thyroidectomy. Radiology **41:** 268–271, September 1943.

9. POLLITZER, H.: Cited by Borak.

SUMARIO

Caso de Exoftalmía Progresiva Consecutivo a Tiroidectomía y Curado por la Irradiación de los Centros Cerebrales

Un caso de exoftalmía grave que revelaba constante agravación a los dos años de una tiroidectomía fué tratado por la irradiación de la región hipofiso-hipotalámica. La exoftalmía disminuyó y otros síntomas de origen simpático desaparecieron.

La irradiación del cuerpo pituitario parece ser la forma lógica de tratamiento para la exoftalmía progresiva consecutiva a la tiroidectomía, dado que se ha conjeturado para dicha glándula la existencia de una hormona excitante de la exoftalmía así como de otra tirotropa. En el caso actual, atribúyense los buenos resultados a la acción de los rayos al producir disminución de la reacción mesenquimatosa retrobulbar, en forma de proliferación celular, edema y éstasis linfático.

Mortality in Swine Exposed to Gamma Radiation from an Atomic Bomb Source[1]

JOHN L. TULLIS, Comdr., MC, USN, BALDWIN G. LAMSON, Lieut., MC, USNR[2] and SIDNEY C. MADDEN, M.D.[2]

THE EXPERIMENT to be described here was designed to determine the lethal dose curve for swine after a single acute total-body exposure to ionizing radiation from an atomic bomb. It is assumed from the data available that swine have about the same degree of resistance to total-body irradiation as human beings. In addition, the morphological lesions appear much alike (3, 6). It is hoped that the data obtained will eventually aid in establishing a lethal dose curve for acute total-body irradiation in man. At present such data for man are limited (1, 2), and only crude estimations are possible. It has been stated, for example, that "severe evidences of radiation injury [in the Japanese] were rare beyond 1,500 yards from the hypocenter" (3). More extensive and exact information would be of considerable importance in prognosis and treatment. Thus, a man known to have received a dose lethal for 10 per cent of those exposed (LD 10) would be predicted to have a 90 per cent chance of recovery and probably be given different treatment from one exposed to an LD 90 or an LD 100.

Studies have previously been made of the mortality in swine from acute exposure to total-body irradiation from x-ray sources of 1,000 kv.p. (4) and 2,000 kv.p. (5), with eighteen to sixty minutes time to deliver the appropriate range of doses. The LD 50, 30 days, for 110- to 240-pound swine with the 1,000-kv. source was approximately 255 r to each lateral aspect of the animal for a total of 510 r. The higher energy (2,000 kv.) source with rays of shorter wave length yielded a similar LD 50 when exposure was unilateral; with bilateral exposure, as with the lower energy source, the LD 50, 30 days, dropped to 350–400 r. These latter data are compared in Table II with the significantly lower LD 50, 30 days, of 230 r estimated from the observations of swine mortality under gamma radiation from an atomic bomb source as reported here.

METHODS

Ninety healthy Landrace-cross test-site-bred and farrowed swine four to six months old, and weighing, two days before irradiation, an average of 67.2 pounds, were divided into nine groups of 10 each, randomized according to weight in such a manner that the weight distribution was the same at each of the nine test stations. On the morning before irradiation, the swine were identified by number and loaded into the liners of exposure cages specially designed to protect them from all atomic-bomb energies except ionizing radiations. They were then placed in the firmly anchored cylindrical exposure cages at the nine target stations. At seven of the stations there were 5 males and 5 females, but at Station 4 there were 10 males and at Station 7 there were 10 females. The sex distribution at Stations 4 and 7 was fortuitous and did not apparently influence the experimental results.

Water containers were filled and identification tags were rechecked just before the swine in liners were inserted into the exposure cages at the target stations.

Within the exposure liners, the swine could stand, lie down, move a few paces forward or backward, and were also able to turn somersaults and thus reverse their

[1] From the Naval Medical Research Institute, Bethesda, Md., and the Brookhaven National Laboratory, Upton, N. Y. The opinions or assertions contained herein are the private ones of the writers and are not to be construed as official or reflecting the views of the Navy Department or the naval service at large. Accepted for publication in February 1953.

[2] Present address, School of Medicine, University of California, Los Angeles.

TABLE I: MORTALITY AND WEIGHT DATA FOR SWINE EXPOSED TO ATOMIC BOMB GAMMA RADIATION: STATIONS 1–3

Station No. and Radiation	Swine No.	Sex	Weight (lb.)				Day of Death
			−2 Day	+2 Day*	+3 Day	At Death	
1	454	M	85	77	74	61	5
1,000 r+	357	F	98	91	82	72	5
	349	F	53	52	48	36	5
	356	M	100	87	88	77	5
	426	M	65	62	59	45	6
	358	F	71	71	60	51	6
	439	F	47	45	40	30	6
	424	M	81	75	74	59	6
	368	F	70	66	54	49	6
	341	M	63	61	55	47	6
2	465	F	66	63	56	48	6
845 r	314	F	88	88	77	75	6
	479	F	48	48	40	37	6
	473	M	84	80	67	59	7
	482	F	67	66	58	51	7
	449	F	40	45	39	33	7
	402	M	87	84	70	65	7
	467	M	81	80	70	61	8
	397	M	63	60	52	45	8
	447	M	63	64	51	43	9
3	470	F	62	56	54	50	6
695 r	387	F	64	63	59	51	7
	442	M	54	51	44	36	7
	410	M	54	53	47	..	7
	351	M	109	104	99	85	7
	431	F	81	81	72	64	8
	359	F	81	79	71	60	8
	321	F	82	82	71	63	8
	392	M	69	66	61	51	8
	310	M	83	86	80	69	8

* +2 day means the second twenty-four hours after the explosion.

positions. Good ventilation, protection from the sun, and maintenance of physiological air temperature and pressure were features provided for in the design of the exposure cylinders.

All animals were placed in the liners so that the left side would face the bomb explosion. It is known, however, that 11 swine turned around before the liners were inserted in the cylinders. Others may have followed this practice, so that accurate data related to the side facing the explosion were not obtained.

Specially trained crews recovered the swine soon after the explosion and returned them to the animal quarters. Here they were observed for radiation illness. The 80 which died were autopsied immediately upon death, and the remaining 10 were sacrificed and autopsied after thirty days. Histologic study revealed that 79 of the 80 spontaneous deaths were related to the radiation injury, the unrelated death being due to a transverse myelitis. This latter animal is not included in the further analysis, and a report on the lesions of ionizing radiation is given elsewhere (7).

As non-irradiated controls, 10 swine (5 males and 5 females) were subjected to the same handling, confinement, and transportation as the test animals. They lost in body weight, during the thirty-six-hour period of confinement and fasting, from 9.2 to 25.6 per cent, a mean of 14.9 per cent, but regained the lost weight within twenty-four hours after having access to unlimited food.

The dose of radiation at the several stations was determined from ionization chambers placed and interpreted by F. W. Chambers, Jr.

OBSERVATIONS

At the time of their recovery from the exposure cylinders during the afternoon of the day of the explosion, all of the swine

TABLE II: MORTALITY AND WEIGHT DATA OF SWINE EXPOSED TO ATOMIC BOMB GAMMA RADIATION: STATIONS 4–6

Station No. and Radiation	Swine No.	Sex	Weight (lb.)				Day of Death
			−2 Day	+2 Day*	+3 Day	At Death	
4	433	M	73	70	64	55	7
575 r	474	M	54	56	52	42	8
	403	M	73	76	71	55	8
	396	M	53	54	47	41	8
	478	M	65	67	63	51	9
	354	M	96	100	97	80	9
	320	M	81	86	81	74	9
	389	M	55	56	48	43	9
	346	M	88	85	78	70	9
	361	M	59	59	53	48	9
5	422	F	49	59	49	42	9
470 r	404	M	61	58	51	45	9
	464	F	49	58	50	44	10
	408	F	45	54	48	39	10
	379	F	73	78	69	67	10
	366	M	92	86	86	82	10
	334	M	69	67	64	55	10
	445	M	54	56	48	42	11
	332	F	80	88	80	73	12
	319	M	79	78	71	70	12
6	412	M	65	67	61	54	10
390 r	451	F	58	62	54	43	10
	312	F	82	76	75	73	10
	386	M	46	47	40	36	11
	376	M	86	86	78	73	11
	407	F	59	54	46	37	11
	455	F	77	78	72	70	11
	370	M	81	80	73	69	12
	372	F	51	52	43	40	12

* +2 day means the second twenty-four hours after the explosion.

were in good physical condition; they showed no evidence of injury and had drinking water available. The stress of confinement appeared well tolerated, perhaps partly because swine are accustomed to lying down for many hours of the day. After their thirty-six-hour fast they were hungry and ate with relish when they were returned to their pens.

Weight loss occurred in the majority of the swine as shown in Tables I, II, and III and may be assumed to have occurred in all, judging from the observations in the non-irradiated controls reported above. The weights shown on +2 day (twenty-four to forty-eight hours after the explosion) were obtained after food had been available from the time of removal from the liners late on the day of the explosion. Some of even the most heavily exposed swine had sufficient appetite initially to equal and even exceed, on this +2 day, their pre-irradiation weights. The weight changes throughout serve as a rough estimate of symptoms. Whereas in Station No. 1, at 1,000 + r, no animal exceeded and only 1 equaled its pre-irradiation weight on +2 day, all 10 swine of Station 9, at 180 r, exceeded or equaled the weight of −2 day. By +3 day some of the rebound was lost all along the line. Only 11 of the 89 animals equaled or bettered their −2 day weights, compared with 36 on the preceding (+2) day. Diarrhea as well as anorexia contributed to this decline. All of those in the first six stations (Tables I and II) lost additional weight before death. Among the later fatalities from lower doses (Table III), though 13 of the 20 regained some of the weight lost, only 2 barely exceeded the pre-irradiation weight. The normal weight curve of growing swine of this age shows an increase usually of 5 to 7 pounds a week. There was definite retardation among the 10 thirty-day survivors of the test.

The *first deaths* occurred on the fifth day in 4 swine exposed at Station 1 (see Table I). The other 6 swine exposed at this sta-

TABLE III: MORTALITY AND WEIGHT DATA OF SWINE EXPOSED TO ATOMIC BOMB GAMMA RADIATION: STATIONS 7–9

Station No. and Radiation	Swine No.	Sex	Weight (lb.)				Day of Death
			−2 Day	+2 Day*	+3 Day	At Death	
7	416	F	50	55	49	44	11
320 r	395	F	50	42	34	41	12
	377	F	73	71	57	62	12
	378	F	75	81	74	61	12
	463	F	64	63	49	53	13
	371	F	52	60	54	48	13
	350	F	86	86	71	81	14
	481	F	46	57	49	47	14
	326	F	63	63	51	54	16
	483	F	57	65	56	62	16
8	480	F	68	65	58	57	13
275 r	365	M	68	67	59	66	13
	441	F	46	46	38	41	13
	417	F	64	66	54	57	14
	325	F	90	82	81	80	15
	466	M	68	67	60	60	15
	385	M	56	53	46	51	16
	355	M	87	91	77	81	19
	469	F	56	50	46	72	†
	432	M	42	42	35	53	†
9	336	F	58	58	55	55	16
180 r	453	F	51	55	49	47	17
	342	M	82	90	85	101	†
	353	M	105	112	102	135	†
	374	M	67	70	70	94	†
	348	F	53	58	54	66	†
	316	F	89	92	86	108	†
	333	F	69	69	64	87	†
	427	M	59	63	54	70	†
	413	M	58	60	54	60	†

* +2 day means the second twenty-four hours after the explosion.
† 30-day survivor, sacrificed after thirty days.

TABLE IV: DAILY MORTALITY OF SWINE EXPOSED TO GAMMA RADIATION FROM AN ATOMIC BOMB

Station No.	Dose (r in Air)	Number of Deaths Daily from 5th through 19th Day after Irradiation														Mean Day of Death
		5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
1	1,000+	4	6	..	..	..	..	..	..	..	..	..	..	..	..	..	5.6
2	845	..	3	4	2	1	..	..	..	..	..	..	..	..	..	..	7.1
3	695	..	1	4	5	..	..	..	..	..	..	..	..	..	..	..	7.4
4	575	..	..	1	3	6	..	..	..	..	..	..	..	..	..	..	8.5
5	470	..	..	..	..	2	5	1	2	..	..	..	..	..	..	..	10.3
6	390	..	..	..	..	..	3	4	2	..	..	..	..	..	..	..	10.9
7	320	..	..	..	..	..	..	1	3	2	2	0	2	..	..	..	13.3
8	275	..	..	..	..	..	..	..	..	3	1	2	1	0	0	1	14.3
9	180	..	..	..	..	..	..	..	..	..	..	..	1	1	..	..	16.5
TOTAL DEATHS		4	10	9	10	9	8	6	7	5	3	2	4	1	0	1	

tion died the following day. At Station 9 (see Table III), where the dose of radiation received was 180 r, with only 2 deaths, 1 occurred on the sixteenth and the other on the seventeenth day.

The *time-distribution of the deaths* at each of the nine stations followed an orderly pattern (Table IV). In general, deaths occurred earlier and ceased earlier in the stations receiving the higher doses and they tended to be more closely grouped in these stations. The mean day of death for all swine exposed at each station grew progressively later as the dose of irradiation received became smaller. The mean was 10.4 days after irradiation. It is interesting that, in the six-day period from the fifth day through the tenth day, 50 of the

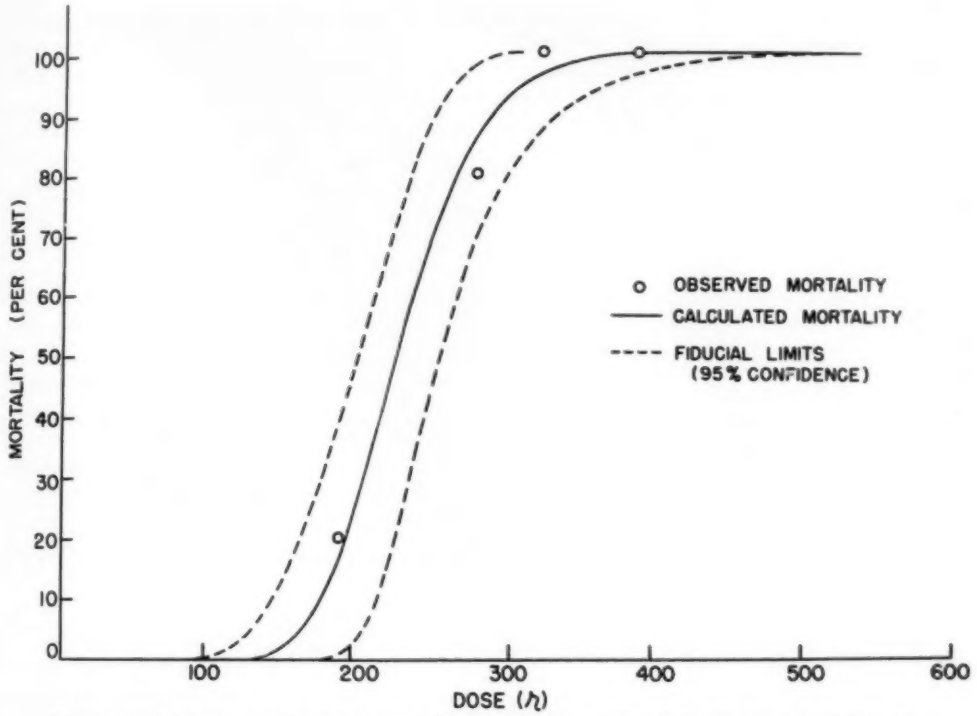


Fig. 1. Lethal dose curve for swine exposed to total-body gamma radiation from an atomic bomb.

total of 79 deaths occurred, while the remaining 29 deaths were spread over the nine-day period from the eleventh day through the nineteenth day.

A *lethal dose curve* (Fig. 1) is obtained from data of Tables II and III. When the 20 per cent thirty-day mortality of Station 9 at 180 r and the 80 per cent mortality of Station 8 at 275 r are taken together with the 100 per cent mortality of Station 7 at 390 r and Station 6 at 320 r, the smooth theoretical curve calculated differs from the observed data by only a fraction of an animal at each point. From the theoretical curve, the *100 per cent lethal dose* of total-body irradiation for 70-pound swine under the conditions of this experiment is about 390 r, while the *50 per cent lethal dose* is about 230 r and the *100 per cent survival dose* is about 130 r.

All the 79 spontaneous deaths analyzed in this study appear to have been due to the pathologic changes which follow ionizing radiation injury, as judged by the clinical, autopsy, and histologic findings. These changes are reported upon elsewhere (7).

DISCUSSION

The conditions under which this experiment was conducted appear to assure valid results. The swine were fully acclimated and had been under the care of a veterinarian since birth. Except for occasional small, local, and regional abscesses in a few animals which had undergone umbilical herniorrhaphies several weeks prior to the test, a few isolated lymph nodes showing chronic inflammatory disease of unknown etiology, and sore feet resulting from abrasion on the concrete animal runs, the swine were disease-free. Variations in body weights were neutralized by randomization prior to placement at test stations. Probably 80 per cent of the swine were exposed left side to the bomb, but the size of the animals and energy of the radiation assured a fairly uniform depth dose throughout the animal, thus reducing the impor-

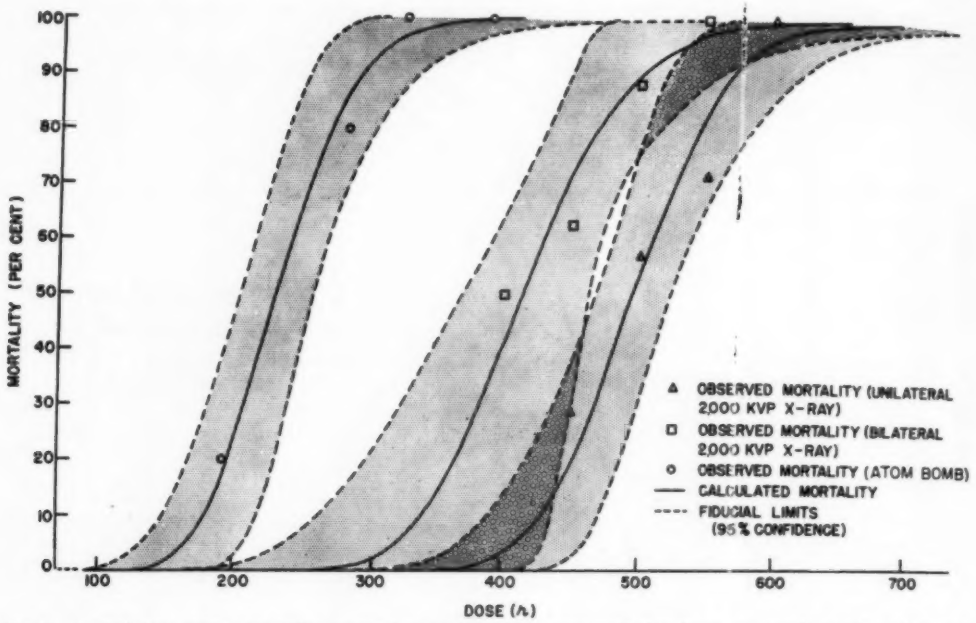


Fig. 2. Lethal dose curves for swine exposed to total-body gamma radiation from an atomic bomb and to unilaterally and bilaterally administered x-radiation.

tance of left-*versus* right-sided exposure (5). The exposure cylinders were identical and thus afforded the same amount of shielding from the bomb energies and the same environment for all of the swine. The cylinders were at fixed stations at known distances from the fixed point of detonation of the bomb. The entire operation, including the loading, transporting, stationing, exposure, and recovery of the animals, proceeded smoothly. The test conditions were simulated with 10 non-irradiated control swine. In short, *the only significant variable in the experiment appears to have been the amount of radiation delivered to each station*, and this was measured. The entire group of 90 test animals, one of which was later discarded as unfit, was protected from blast, fire, heat, and weather while being exposed simultaneously under essentially uniform conditions to the ionizing radiations of the atomic bomb.

There are marked differences in the experiments here reported and the x-radiation control experiments reported previously (4, 5). The smaller size of the swine, the 36-hour fast in confinement, the vastly increased dose rates, the energy of the bomb irradiation, and the shielding afforded by the aluminum cylinders are the chief features in which the field experiment differs from the conditions of the laboratory experiment.

The lower range of the lethal-dose curve for swine exposed to gamma radiation from an atomic bomb as compared to unilateral and bilateral 2,000-kv.p. x-irradiation is illustrated in Figure 2 and is not certain of correct interpretation. The shape and slope of the three curves are strikingly similar, but there are marked differences in the point values of the lethal-dose curves produced by the three methods of irradiation. The dependence of lethality on the uniform distribution of the dose within the irradiated subject has been evaluated in a study of unilateral *versus* bilateral 2,000-kv.p. x-irradiation (5). Depth-dose measurements indicate that the dose received by the gamma-irradiated swine was very evenly distributed throughout the bodies of the animals. Possibly because of this more efficient dose distribution, the atomic bomb lethal-dose curve is in a lower dose range

than either of the 2,000-kv.p. x-ray lethal-dose curves.

Although one may be tempted to compare the observations in swine with those recorded for the human casualties at Nagasaki and Hiroshima, it is obviously impossible to do so with any assurance. The animal experiments were well controlled, whereas the Japanese bombings were war measures yielding radiation exposure and post-exposure variables which can be estimated only crudely. The psychological state favoring forgetfulness of locus, the partial body shielding by interposed clothing and physical structures, the complications of multiple injuries and diverse types of injury, and differences in post-exposure medical treatment are only some of the variables which compound to confuse the interpretation of the effects of the bomb.

SUMMARY AND CONCLUSIONS

1. Ionizing radiation from an atomic bomb was sufficient to kill 100 per cent of swine receiving between 320 and 1,000 r.

2. Eight of 10 swine which received 275 r died on or before the nineteenth day after exposure; 2 survived for thirty days, at which time they were killed for study.

3. Two of 10 swine which received 180 r died on or before the seventeenth day after exposure, but the remaining 8 survived for thirty days, at which time they were killed.

4. By calculation, 100 per cent of the swine would be expected to die when irradiated with 390 r, 50 per cent would be expected to die when irradiated with 230 r, and 100 per cent would be expected to survive when irradiated with 130 r.

5. The experimental data agree closely with the calculated expected results and, when the variables are taken into account, with previous 2,000 kv.p. x-irradiation control studies.

ACKNOWLEDGMENTS: The authors wish to extend sincere thanks to a large staff whose wholehearted co-operation and assistance contributed to and made possible the completion of this experiment. Special thanks are due F. W. Chambers, Jr., radiation physicist, Robert Veenstra, veterinarian, Richard H. Lee, statistician, and to James S. Otto, laboratory technician.

REFERENCES

1. Joint Commission for the Investigation of the Effects of the Atomic Bomb in Japan: Medical Report. To be published.
2. HEMPELMANN, L. H., LISCO, H., AND HOFFMAN, J. G.: The Acute Radiation Syndrome: A Study of Nine Cases and a Review of the Problem. Ann. Int. Med. **36:** 282–510, February 1952.
3. LIEBOW, A. A., WARREN, S., AND DECOURSEY, E.: Pathology of Atomic Bomb Casualties. Am. J. Path. **25:** 853–1027, September 1949.
4. TULLIS, J. L., TESSMER, C. F., CRONKITE, E. P., AND CHAMBERS, F. W., JR.: The Lethal Dose of Total-Body X-Ray Irradiation in Swine. Radiology **52:** 396–400, March 1949.
5. TULLIS, J. L., CHAMBERS, F. W., JR., MORGAN, J. E., AND ZELLER, J. H.: Mortality in Swine and Dose Distribution Studies in Phantoms Exposed to Supervoltage Roentgen Radiation. Am. J. Roentgenol. **67:** 620–627, April 1952.
6. TULLIS, J. L.: The Response of Tissue to Total Body Irradiation. Am. J. Path. **25:** 829–851, September 1949.
7. TULLIS, J. L., LAMSON, B. G., AND MADDEN, S. C.: Lesions in Swine Induced by Total Body Exposure to Gamma Radiation from an Atomic Bomb Source. In preparation.

SUMARIO

Mortalidad en los Cerdos Expuestos a la Radiación Gamma Procedente de una Bomba Atómica

A 90 cerdos se les expuso en idénticos cilindros incombustibles e inexplosivos de aluminio a dosis graduadas de rayos yonizantes (con predominio de los gamma), procedentes de una bomba atómica. Setenta y nueve de los animales sucumbieron de cinco a diecinueve días más tarde a consecuencia de las lesiones irradiatorias experimentadas. La mortalidad fué de 100 por ciento en siete puestos experimentales en que se reciberon dosis de irradiación que variaron de 320 a 1,000 r, de 80 por ciento en un puesto en que la dosis fué de 275 r y de 20 por ciento en un puesto en que la dosis representó 180 r. La dosis letal calculada de 100 por ciento fué de unos 390 r, la dosis letal de 50 por ciento de unos 230 r y la dosis de 100 por ciento de sobrevivencia de unos 130 r. Las dosis de irradiación se midieron al aire, con las cámaras de yonización calibradas en roentgens.

Body-Section Radiographic Equipment: Modifications and Accessories[1]

W. BERKELEY ZINN, M.D.

FACILITIES for making body-section roentgenograms of the lungs are now considered a necessary part of the radiographic service of any sizable tuberculosis hospital. Usually a single level is radiographed on a single film, 8 × 10 inches or larger. A number of films are thus obtained, which must be sorted and arranged in sequence before they can be adequately interpreted. Such sorting of films is an unnecessary, time-consuming nuisance. Some have in part eliminated it by making two or four exposures on a 14 × 17-inch film, divided into halves or quarters with lead-rubber masks. (When the film is quartered or halved horizontally, in the usual film-viewing position, it is necessary to invert the cassette for half the exposures on each film.) While the film sorting problem is greatly simplified by this procedure, with existing equipment some of the radiographic images are either reversed or upside down and interpretation is still unnecessarily involved.

Since in most instances the region to be examined (at least in the lungs) has previously been fairly well localized, it can usually be adequately covered by one-fourth of a 14 × 17-inch film (7 × 8½ inches, which in the average person will cover about two-thirds of one lung field). If all four radiographic images on a 14 × 17-inch film could be upright, with none reversed, film sorting would be largely eliminated and film storage and interpretation would be greatly simplified.

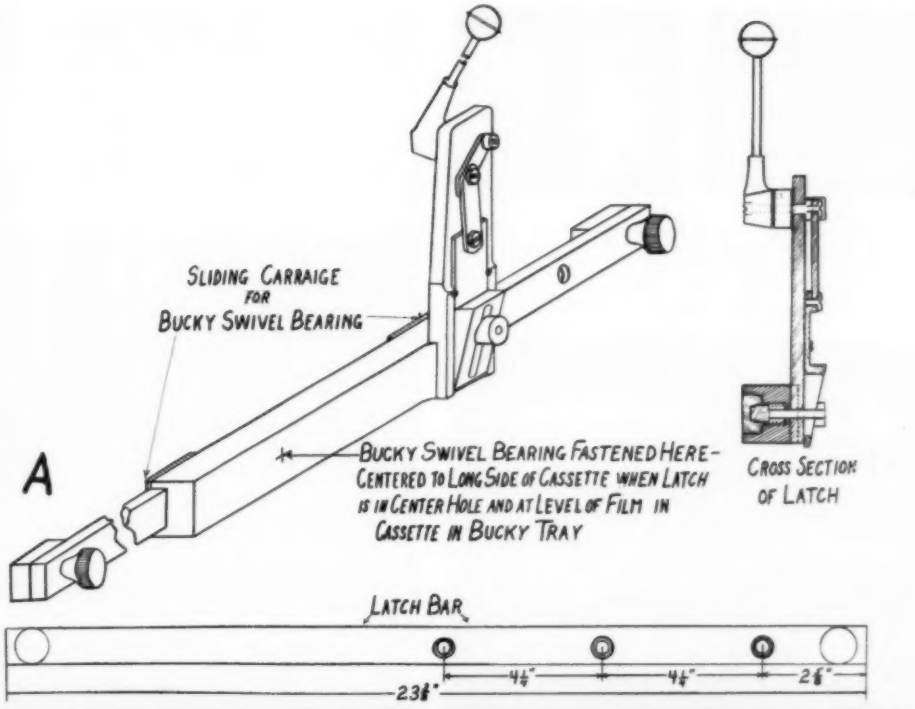
It is the purpose of this paper to describe simple modifications of present body-section radiographic equipment to make this possible, as well as certain accessories that have proved useful to us.

Modification 1: The first modification is illustrated in the drawing and photograph in Figure 1. It consists of a substantial brass bar ("latch bar") which is attached to the Bucky carriage on the back of the table. Brass spacer blocks are permanently fastened to the Bucky carriage, containing indexing pins which engage holes in each end of the latch bar. The latch bar is held in position on the spacer blocks with a single large thumb screw at each end (the thumb screw extending only into the spacer blocks). In the latch bar, toward one end, are three tapered holes on 4¼-inch centers.

On the latch bar is mounted a sliding carriage equipped with a spring-loaded tapered pin lock which, in the locked position, engages any one of the three holes in the bar. (The pin lock and holes are tapered to eliminate unwanted play as these parts wear from use.) The latch is at one end of the sliding carriage and is released by a single movement of the handle which, through a short lever and link, pushes a wedge under the head of the spring-loaded tapered pin. Near the other end of the carriage is mounted the Bucky swivel bearing. This swivel bearing engages the lower end of the connecting lever which moves the Bucky carriage (and film) in one direction while the x-ray tube moves in the opposite direction about the fulcrum. Positioning and permanently fastening the Bucky swivel bearing to the sliding carriage is one of the last steps in the assembly of the device. The swivel bearing should be centered at the level of the film, in the cassette, in the Bucky tray, and centered to the long side of a 14 × 17-inch cassette when the latch is engaged in the *middle hole* of the latch bar.

Small brass stop blocks are permanently fastened to the latch bar at each extreme of travel of the sliding carriage, being so positioned that, when the carriage is firmly against either stop, the pin lock will drop into the corresponding end hole in the

[1] From Ray Brook State Tuberculosis Hospital, Ray Brook, N. Y. Accepted for publication in March 1953.



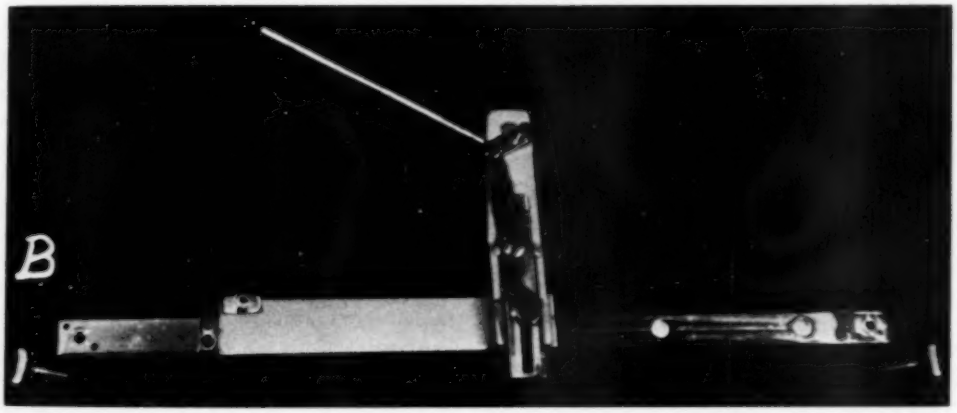


Fig. 1. Modification 1. A. Drawing of the device. B. Photograph of the device including thumb screws for mounting on Bucky carriage. See text for complete description.

latch bar. These simplify operation of the device from the front of the table and eliminate having the pin latch in the middle hole when shifting from one end position to the other. These brass stop blocks are shown in the photograph but not in the drawing of Figure 1.

Modification 2: Modification of a Bucky cassette tray is necessary to permit lateral movement of the cassette in the tray. A plain Bucky cassette tray without the cassette-locking device was obtained directly from Liebel-Flarsheim Company. On this tray, hard wood strips were mounted with wood screws. The strip on the back of the tray is of such thickness that,

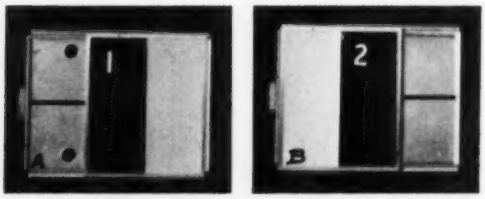


Fig. 2. Modification 2. Modified Bucky cassette tray showing hardwood strips which limit the lateral movements of the cassette in the tray and the position of the cassette lead rubber masks for planigraphic examination of one entire side of the chest.

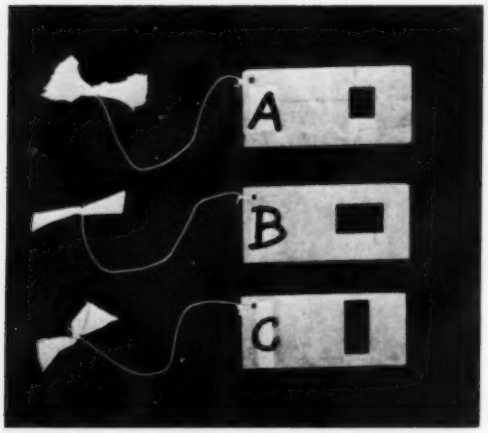


Fig 3. Lead diaphragms which slip into cone slot on x-ray tube head. A. For four exposures on one 14 × 17-inch film. B. For two exposures on one 14 × 17-inch film, dividing film horizontally. C. For two exposures on one 14 × 17-inch film, dividing film vertically. See A, B, and C, Fig. 6.

Objects at left of illustration are different colored pieces of cloth tied to diaphragms with string. These indicate at a glance which diaphragm is in position and, more important, that a diaphragm is in the cone slot when changing over from planigraphy to regular radiography.

when the cassette is firmly against this strip (A, Fig. 2), the near half of the cassette is centered to the center of the table top. The front strip is so positioned that, when the cassette is firmly against it, the far half of the cassette is centered to the table top (B, Fig. 2). In either instance the cassette tray is pushed all the way into the slot in the Bucky carriage before the radiographic exposure is made. On some older x-ray equipment the Bucky tray is too narrow to permit this modification. As far as the author has been able to determine, however, it is readily accomplished with all Liebel-Flarsheim Bucky trays, with which most x-ray tables are now equipped.

ACCESSORIES

Lead rubber masks (lead equivalent 0.5 mm. lead) are made in the following sizes: (1) one slightly less than 7 × $8^1/_2$ inches, (2) one 14 by slightly less than $8^1/_2$ inches, and (3) one 17 by slightly less than 7 inches. These are used on the cassette to shield all portions of the film except that being exposed. The first two are shown in Figure 5, and the third in Figure 2.

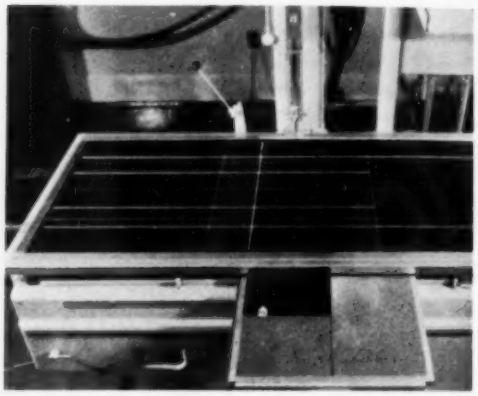


Fig. 4. Guide lines on table top which greatly facilitate positioning of patient. Guide line across table top indicates position of upper edge of that portion of film being exposed when making four exposures on one 14 × 17-inch film.

The technical quality of planigrams done at kilovoltages below 75 was not satisfactory, but above this kilovoltage the lead rubber masks did not give sufficient protection to the film: faint multiple images appeared and interfered with interpretation. For this reason, lead diaphragms were fashioned to be mounted in the cone slot on the tube head. These are shown in Figure 3. They are made of $^1/_8$-inch lead, and the outside dimensions are such that they snugly fit the cone slot on the tube head. The holes are made by the "cut and try" method. The approximate center of the hole is marked and a $^3/_8$-inch round hole is drilled. The diaphragm is placed in the cone slot and a film exposed

(the equipment having been set up for doing planigrams). The position and size of the round black spot on the film after development are used as a guide in enlarging the hole in the diaphragm. (On our machine this exposure was made at 40 inches focal spot-film distance.) The black spot on the film measured about $4^1/_2$ inches; therefore $^1/_8$ inch at the lead diaphragm equaled about $1^1/_2$ inches on the film with a 40-inch focal spot-film distance.

In making the diaphragms, the object is to get complete, uniform coverage of that portion of the film being exposed to x-radiation, with as little overlap on other portions of the film as possible. With these lead diaphragms, we have used as much as 15 ma. at 120 kv.p. without obtaining multiple images due to the inadequate protection by the lead rubber masks. The use of the diaphragms also appreciably decreases the amount of irradiation received by the patient which, in turn, reduces the amount of secondary radiation fogging of the film. This reduction in secondary radiation fogging improves visibility of detail; this is, of course, most evident when the diaphragm with the smallest opening is used in making four exposures on one 14 × 17-inch film.

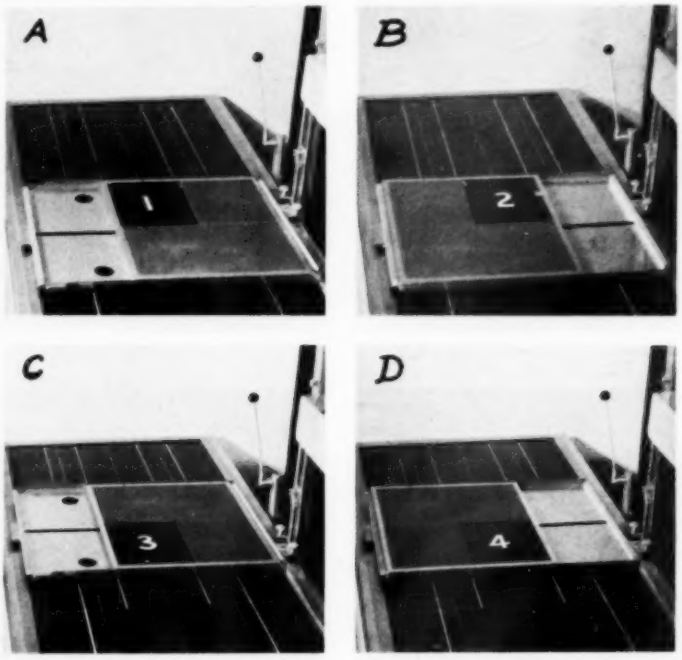


Fig. 5. Position of lead-rubber masks on cassette, position of cassette in modified Bucky cassette tray, and relation of cassette to the fulcrum and connecting lever for each of four exposures on one 14 × 17-inch film.

OPERATION

It should be noted that in examining a patient the area of interest is centered to the table top: *i.e.*, the chest if both upper lungs are being examined but only one side if a single lung is to be studied. Guide lines are made on the table top (shallow grooves are cut and filled with white lacquer) to facilitate positioning the patient. The two inner longitudinal lines are 7 inches apart ($3^1/_2$ inches either side of the center line). A line extending across the table indicates the position of the upper edge of that portion of the film being exposed when four exposures are being made on one 14 × 17-inch film.

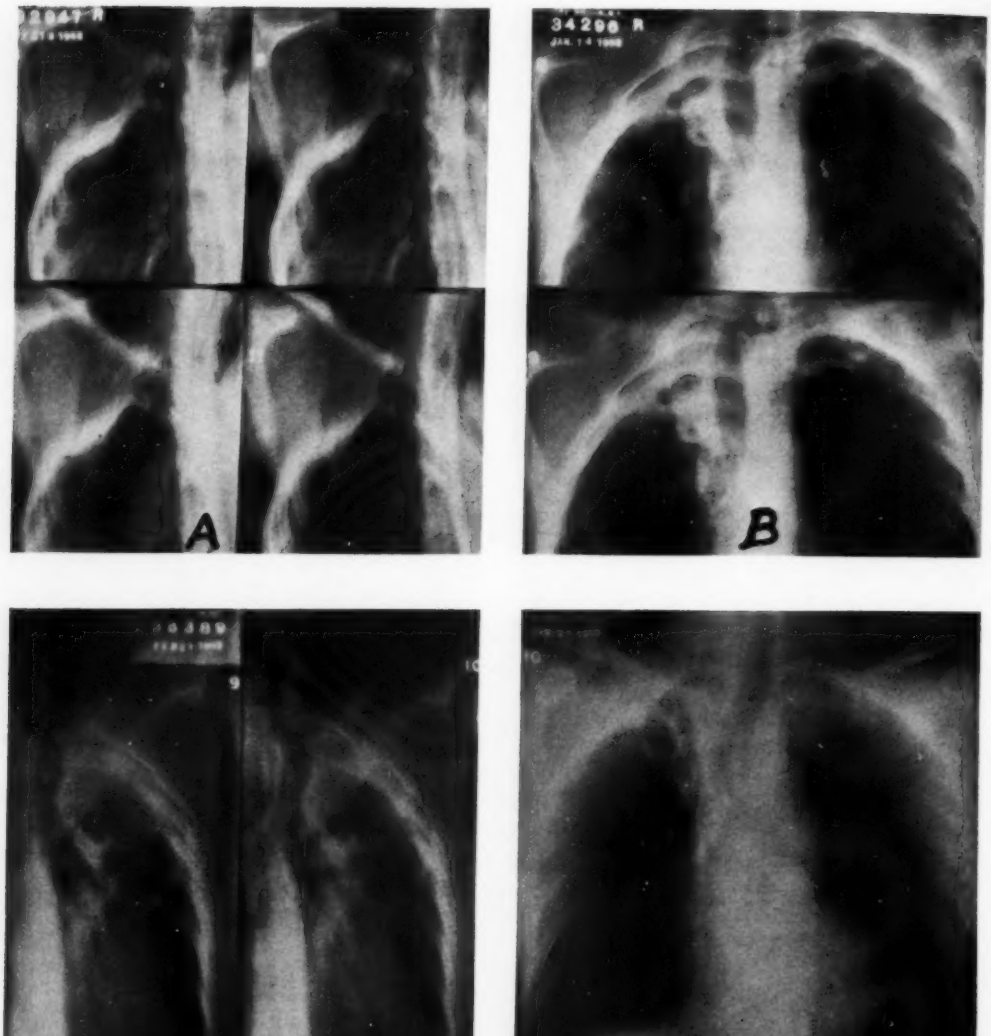


Fig. 6. Different arrangements of levels possible on a 14 × 17-inch film with the modifications and accessories described. All radiographic images are upright and in sequence.

These guide lines are shown in Figure 4.

With both modifications, it becomes a simple matter to obtain one, two, or four images, all upright and in sequence, on 14 × 17-inch films, as shown in Figure 6.

The operations necessary in making four exposures on one 14 × 17-inch film (A, Fig. 6) are as follows. The small lead diaphragm (A, Fig. 3) is inserted in the cone slot. The device described under Modification 1 is attached to the back of the Bucky carriage with the two thumb screws. The fulcrum is fastened to the table top, and the lever connecting x-ray

tube, fulcrum, and Bucky carriage is fastened in position. The modified Bucky tray is inserted in the carriage and a 14 × 17-inch loaded cassette is placed in it. The proper lead rubber masks are placed on the cassette, covering three-quarters of the film (A, Fig. 5). (In Fig. 5, for the sake of clarity, the Bucky tray has been removed from the Bucky carriage and placed in a corresponding position on the table top. This shows the position of the cassette and lead rubber masks, and the relation of that portion of the film being exposed to the Bucky swivel bearing, lever, and fulcrum.) Appropriate lead identification, date, and level markers are fastened to the cassette with adhesive tape. The fulcrum is set at the corresponding level, the latch on the device is released, and the Bucky carriage moved as far toward the foot of the table as it will go.

It should be noted here that, since the Bucky swivel bearing must remain engaged in the lower end of the connecting lever, the latch bar (attached to the Bucky carriage) is moved in the sliding swivel carriage rather than the reverse, which the name "sliding swivel carriage" would imply. The sliding carriage is locked in this position (the pin lock engaging the hole at one end of the latch bar). This centers the upper half of the cassette to the Bucky swivel bearing (A, Fig. 5). The cassette is pushed against the back stop of the Bucky cassette tray and the tray is inserted all the way into the Bucky carriage. The first exposure is made. The level of the fulcrum is changed, the cassette is moved against the front stop of the tray, the small lead rubber mask is shifted (B, Fig. 5), the lead number level marker is applied, and the tray pushed in. The second exposure is made.

The latch on the device is now released and the Bucky carriage moved to the other extreme of its travel and locked in the other end hole of the latch bar. This centers the lower half of the film to the Bucky swivel bearing. The fulcrum level is adjusted. The lead rubber masks are arranged and the lead level marker is applied. The cassette is pushed against the back stop of the Bucky tray (C, Fig. 5), the cassette tray is pushed all the way in, and the third exposure is made.

The cassette is now moved against the front stop of the tray, the lead rubber masks adjusted (D, Fig. 5), the fulcrum level set, proper lead level marker applied, tray pushed in, and fourth exposure made. This procedure is repeated for each succeeding film.

For two exposures, when one entire side of the chest is being examined (B, Fig. 6), only the lateral shift of the cassette in the modified Bucky tray is used, the pin lock of the device being locked in the center hole of the latch bar. The lower lead diaphragm (C, Fig. 3) is used in the cone slot.

For two exposures, when both lung apices (C, Fig. 6) are being examined, the standard Bucky tray which centers the cassette to the table top and the longitudinal shift of the sliding carriage are used, locking the sliding carriage in one end hole of the latch bar for the first exposure, the other end hole for the second exposure. The lead diaphragm illustrated in Figure 3(B) is used in the cone slot.

COMMENT

While only anteroposterior planigrams are illustrated, the modifications and accessories described are equally useful in making lateral planigrams.

It should be possible to adapt the device described under Modification 1 to most radiographic tables fairly easily. The necessary changes would be the provision of suitable mounting brackets or spacer blocks on the Bucky carriage, for mounting the latch bar, and modification of the Bucky swivel bearing to permit coupling with the lower end of the lever connecting x-ray tube head, fulcrum, and Bucky carriage. Adequate clearances must, of course, be maintained to permit free movement of the various parts throughout their maximum excursion.

SUMMARY

Modifications of present body-section roentgenographic equipment have been

described and illustrated. These make it possible to obtain 4 exposures of successive levels on one 14 × 17-inch film—all exposures upright, in normal viewing position, and in sequence. Film sorting is thereby largely eliminated and film storage and interpretation are considerably simplified.

Certain accessories have been described which reduce the amount of irradiation received by the patient and improve the quality of body section roentgenograms.

ACKNOWLEDGMENTS: The author is grateful to Mr. E. W. Vander Linden of Rochester, N. Y., for his suggestions and for the actual construction of the device described under Modification 1, and to Miss Anna Sanlow of the Ray Brook State Tuberculosis Hospital for preparing the illustrations.

Ray Brook State Tuberculosis Hospital
Ray Brook, N. Y.

SUMARIO

Instalación Radiográfica para Tomografías: Modificaciones y Accesorios

Descríbense aquí e ilústranse con grabados ciertas modificaciones de las actuales instalaciones radiográficas para tomografías. Permiten las mismas obtener 4 exposiciones de niveles sucesivos en una película de 35 × 42.5 cm., con todas las exposiciones verticales, en la posición visual normal, y consecutivamente. Elimínase así en gran parte el sorteo de las radiografías y se simplifican la conservación y la interpretación de las películas.

Descríbense ciertos accesorios que reducen la cantidad de irradiación recibida por el paciente y mejoran la calidad de las radiografías de las distintas secciones del cuerpo.

Absorption of X-Rays by Tissues of the Head and Neck[1]

M. G. WHEATCROFT, Comdr., DC, USN, and J. E. MORGAN, Comdr., MSC, USN

DURING a series of experiments on dogs involving saliva analyses prior to and following irradiation, it became desirable to know the dose received by the salivary glands, teeth, and jaws following unilateral and bilateral exposures. Pertinent data could not be found in the literature.

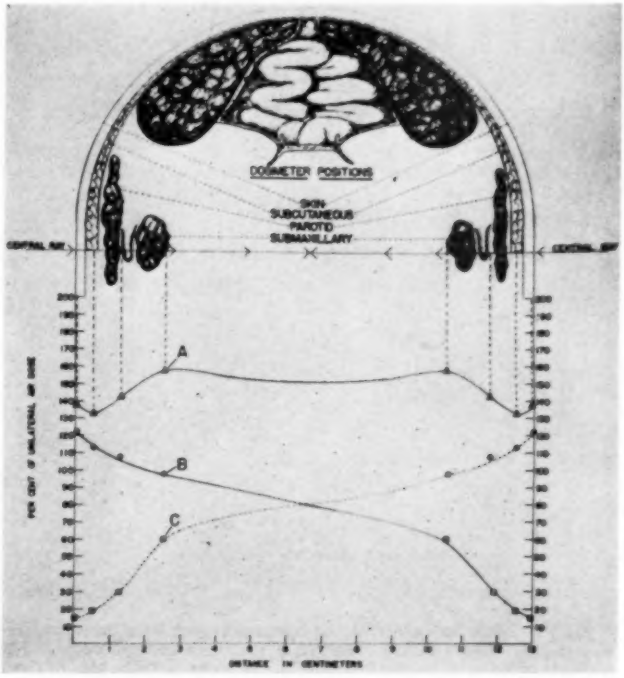


Fig. 1. Effect of unilateral and bilateral exposure on the x-ray dose received by the salivary glands. The ordinate of Point A, on the bilateral exposure curve, is the sum of those at Points B and C on the unilateral exposure curves, etc.

EXPERIMENTAL

The dogs used were from other experiments and were due to be sacrificed. This was accomplished by an overdose of Nembutal intravenously. Three animals were used, weighing 7.2 kg., 13.8 kg., and 25 kg. Immediately after death the following areas of the neck were displayed by blunt dissection, and cavities were made large enough to accommodate a 25-r Victoreen chamber: (*a*) subcutaneous, lateral to the left parotid; (*b*) medial to the left parotid; (*c*) medial to the left submaxillary; (*d*) medial to the right submaxillary; (*e*) medial to the right parotid; (*f*) subcutaneous, lateral to the right parotid.

The various areas for positioning of the ionization chamber are shown schematically in Figure 1. All measurements were

[1] From the Naval Medical Research Institute, National Naval Medical Center, Bethesda, Md. The opinions or assertions contained herein are the private ones of the authors and are not to be construed as official or reflecting the views of the Navy Department or the Naval Service at large. Accepted for publication in March 1953.

made along the central ray, at points corresponding to intersection of the vertical lines from Curve A.

The radiation factors were as follows: 200 kv.p., filtration 0.25 mm. Cu plus 1.0 mm. Al, h.v.l. 0.8 mm. Cu, target-skin distance 57 cm., cone area 20 × 20 cm.

The head of the animal was cut in a transverse sagittal plane, through the salivary glands, so that actual distances between positions, *versus* doses received, could be plotted for anatomical correlation.

The effect of the teeth and mandible upon x-ray absorption was determined by placing the ionization chamber in the various intra-oral positions indicated along the central ray in Figure 2. After completion of the exposures, a transverse section was cut through the lower jaw and the distances were measured as indicated on the abscissa scale.

RESULTS AND DISCUSSION

The transmission curves on the three dogs of different weights and head measurements can be seen in Figure 3. Since these curves are of the same type, the data from the largest dog (total diameter along central ray 13 cm., comparable to human dimensions) was used to compile Figure 1. As can be seen in Figure 1, the rate of absorption is nearly linear until the second submaxillary gland is penetrated; the absorption is then considerably increased. The bilateral exposure curve is determined by the sum of the entrance and exit doses of the two unilateral exposures. These are expressed as per cent of one (unilateral)

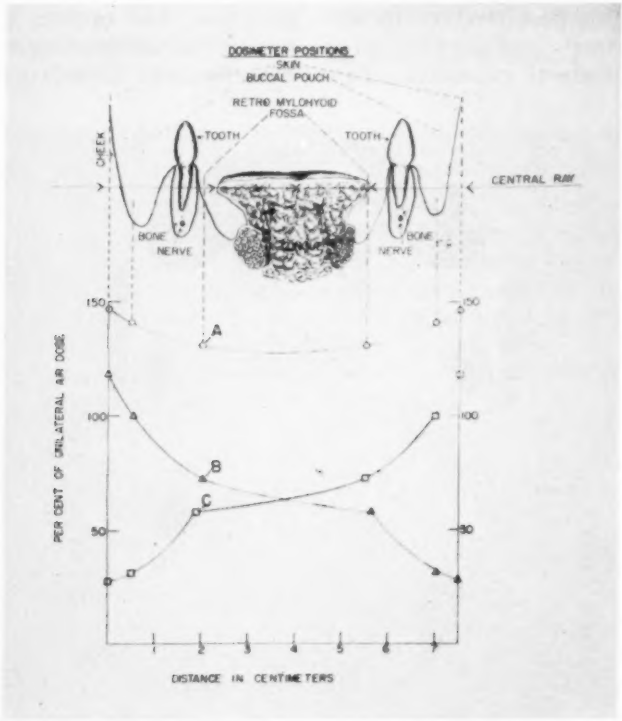


Fig. 2. Effect of unilateral and bilateral exposure on the x-ray dose received by tissues during exposure of the teeth and mandible. The ordinate of Point A, on the bilateral exposure curve, is the sum of those at Points B and C on the unilateral exposure curves, etc.

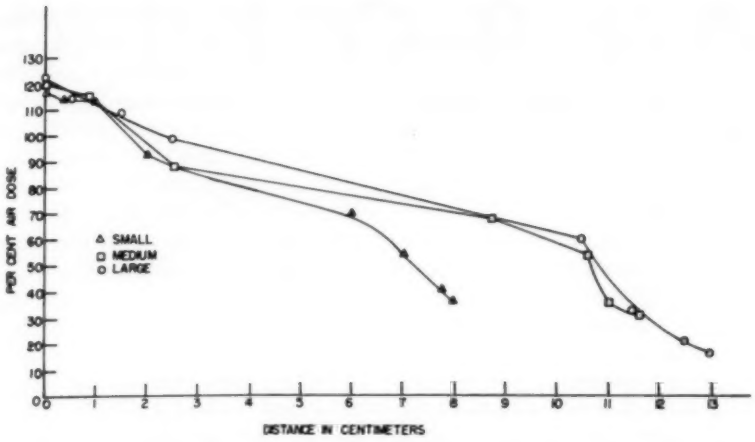


Fig. 3. Effect of x-ray absorption on transmission curves when the exposure was made through the salivary glands of dogs of different size.

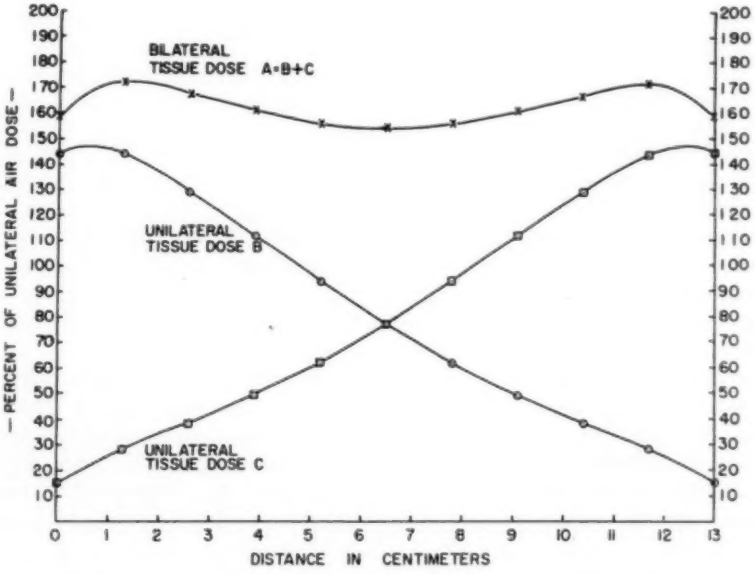


Fig. 4. Unilateral and bilateral x-ray dose distribution in a 13-cm. cubical masonite phantom. In the preceding curves, abrupt changes of slope were seen to coincide with anatomical boundaries between structures of differing density. This homogeneous phantom material of course produces no such discontinuities.

incident air dose. In unilateral exposure of 100 r, the skin received approximately 120 r; however, in a bilateral exposure of 100 r, the skin receives approximately 138 r and the parotid gland 160 r, or the entrance plus the exit dose.

The effect of the mandible and teeth on unilateral and bilateral exposures can be seen in Figure 2. If the unilateral curve is compared with the unilateral curve through the salivary glands (Fig. 1), it can be seen there is more absorption by tissues of the mandible. This absorption is reflected in the bilateral exposure curve.

When the teeth and mandible are given bilateral exposures, as in obtaining intradental films, the skin of the cheeks receives the greatest dosage. The skin dose in a bilateral exposure can be calculated from Figure 2, and is approximately 50 per cent more than the calculated air dose for a single unilateral exposure.

Beyond the original purpose of this study, the data presented also appear of some interest in clinical radiology, since bilateral exposure technics are frequently applied in cancer of the oral cavity. While conditions of this experiment tend to exaggerate the importance of scattered components, due to large field area, the same tendencies may also be observed to a lesser degree in case of smaller cone apertures.

SUMMARY

X-ray doses received by the salivary glands, teeth, and mandible during unilateral and bilateral exposures were measured by the Victoreen condenser r meter. During bilateral irradiation of salivary glands of dogs, the parotids received a larger dose than any other tissue, and this was approximately 60 per cent more than the calculated air dose. During bilateral irradiation of the teeth and mandible, the skin received a larger dose than the other tissues, and this amounted to approximately 50 per cent more than the calculated air dose.

During bilateral x-ray exposure, the total dose to any tissue is the arithmetical sum of the individual doses from each side, and this varies according to tissue absorption of x-rays.

Comdr. J. E. Morgan, MSC, USN
Naval Medical Research Institute
Bethesda 14, Md.

SUMARIO

Absorción de Rayos X por los Tejidos de la Cabeza y del Cuello

Las dosis de rayos X recibidas por las glándulas salivales, los dientes y las mandíbula durante exposiciones uni- y bilaterales fueron medidas con un contador-r condensador Victoreen. Los factores de la irradiación fueron los siguientes: 200 kv.p., filtración 0.25 mm. de cobre más 1.0 de aluminio, capa de hemirreducción 0.8 mm. de cobre, distancia foco-piel 57 cm., área del cono 20 × 20 cm.

Durante la irradiación bilateral de las glándulas salivales de los perros, las parótidas recibieron una dosis mayor que ningún otro tejido, siendo ésta aproximadamente 60 per ciento mayor que la dosis calculada al aire. Durante la irradiación bilateral de los dientes y la mandíbula, la piel recibió la dosis máxima siendo la misma aproximadamente 50 por ciento más que la dosis calculada al aire.

Durante la exposición bilateral a los rayos X, la dosis total en cualquier tejido representa la suma aritmétrica de las dosis individuales de cada lado, lo cual varía conforme a la absorción de los rayos en los tejidos.

EDITORIAL

Trends in Modern Medicine[1]

At the present time there is much talk about the future of America's medicine. The physician, the hospital, the government, voluntary and commercial insurance plans as well as the public, are vitally interested in the trend of Medical Economics of the future. We are on the threshold of a new era in the growth and expansion of health service. In the past ten years we have witnessed dramatic advances in the prevention, diagnosis, and treatment of illness, and there is every reason to believe that in the next ten years scientific progress in the development of new methods for the care of the sick and injured will exceed in importance those of the last half century.

At the same time that scientific advances have been going forward at a rapid rate, there have been other developments of equal importance. During the past decade we have increased our total consumer expenditures for health by almost 300 per cent. The increase of our expenditures of tax funds for health purposes has been even greater. Part of these larger expenditures are due to higher costs and a growing population. Even after allowing for these factors, the fact remains that we have allocated in the past decade a higher percentage of personal and national resources to health than ever before in our history. This has made possible higher utilization of health services and higher standards of care. It is right and proper that we raise our expenditures for health and that we continue to increase our consumption of health services. The price of health service in our economy is growing and will continue to grow. Modern medicine costs more because the unit of service is more complex and the types of illness have changed significantly.

The general increase in the effectiveness of American medicine through widespread and scientific technical developments has brought to the minds of our citizens a demand for first-class medical care. Despite the improved national health and the miraculous life-saving advances in medical investigation, general dissatisfaction is evident. There has been no proper meeting of the minds, no true understanding between the physician and the public. The physician-patient relationship functions at its highest only when there is a personal, co-operative, confident spirit between the parties involved. A lack of understanding will eventually destroy successful operation of any kind of medical service.

The future of medicine in the United States depends on the physician. Are we going to continue to sit back and "let someone else do it." Or are we going to take our rightful position and help steer our course away from the brink of disaster. Everyone knows the shortcomings of the present system of medicine. There are admitted shortages of personnel and facilities in some places, although states and localities are doing much to correct these evidences of mal-distribution. Some physicians, and a larger percentage of hospitals, charge too much. More physicians and other types of personnel must be produced. The medical schools are caught in a three-way dilemma; there is pressure for more graduates, need for maintaining high standards, and inability to get sufficient funds.

[1] Presidential Address, delivered before the Radiological Society of North America, at the Thirty-ninth Annual Meeting, Chicago, Ill., Dec. 13–18, 1953.

The economic aspect of a long illness is a major problem. Whenever and wherever illness strikes, it is costly. When the illness is serious and endures for months, or even weeks, it can be catastrophic economically for the patient and his family. How frequently such an illness occurs, how many people are affected, how great the financial costs, and how well the cost is being met are part of the data which we must provide. The frequency and extent of a long illness have been and are being used in arguments both for and against such proposals as extension of employee benefit plans, compulsory sickness compensation, and national health insurance.

The average American family does not have the financial resources necessary for a long siege of illness. A worker forced to be absent from the job for weeks or months at a time, incurring substantial medical, hospital, and perhaps surgical expenditures, may be faced with an insurmountable financial burden.

There are other considerations to be taken into account in our approach to building and expanding health service. One of these is increasing longevity. In specific terms, it is expected that the number of persons over sixty-five years of age will probably increase by more than 6 per cent in the next twenty-five years. The general educational level of our people will continue to rise, and they will be more articulate and insistent in their demands for the highest level of health service obtainable. Equally important is the expectation that the standard of living of the American people will increase by 3 to 5 per cent a year. These important considerations cannot be overlooked in making public relations decisions for the health job ahead.

One of the great problems confronting the physician of today is financing hospital care for his patients. The medical staff of the present-day hospital is entirely shut off from any of the economics of the institutions where he cares for his sick patients. It has always seemed to me there are certain questions into which the medical profession should inquire and perhaps help solve. We should attempt to determine how much of the increased cost of hospitalization is due to expanding services and how much to higher costs of labor, personnel, and material. The physician is probably responsible for more than 50 per cent of the hospital cost. He demands much. Before demanding, he should study the relationship between medical needs and the cost of medical care. He must determine whether his patient has any method of paying his hospital bill. We as physicians must decide upon the scope, type, and cost of coverage and the utilization of hospital services. What the cost will be will depend upon what we demand. If we as physicians want unlimited coverage, the cost will be so high that the voluntary plans will have to price themselves out of business into the hands of government control, where taxes will take care of the deficit.

Hospitals, by the very nature of their function, encounter immediately a psychological situation that tends to frustrate understanding, due to the revulsion on the part of most persons to illness, injury, disease, and death. It virtually defies ready comprehension for the average person. He is not only sick, but he is obliged to pay dearly for his unwanted illness. Are we utilizing voluntary prepayment methods to the best of our ability? Are we closing up the gap, the defects in the plans, which we now have? Are we bridging the chasms in our own organization, neutralizing inertia, indifference, smugness, and complacency? Are we solving the problem of inadequate medical care? Are the executive directors of the local and national voluntary plans and their boards of trustees realizing their responsibilities or are they widening the gulf that exists between them on the one hand and the hospital and physicians on the other? Do they lack interest and knowledge in regard to medical care, hospitalization, and the ill patient? Are they, through their lack of intelligent co-operation, building the pathway that leads to socialized medicine and

hospitalization instead of continuing the efforts to improve plan-hospital-physician relationships and thus improve the care of the patient? No longer can we as physicians shirk our community responsibilities and still do justice to our profession. It is time for the doctors of medicine, you and me, to take our place among our fellow men in our communities to such an extent that we may steer our futures wisely.

These and many more gigantic questions are part and parcel of our future. It is no time to relax; instead, the present favorable political environment should be as meat and drink to our profession—a stimulus to answer these many questions with constructive, progressive measures. Physicians agree that the care of the chronically ill person is the greatest problem confronting the medical profession. Complicating this problem is the blind acceptance by the public of endorsement of any and all medical products, the exploitation of medical science by radio, television, magazines, and newspapers. American editors have committed many crimes against the morale and good health of the American people. They have sent patients out on unnecessary, expensive journeys, often in search of non-existing miracle cures. They have made the many honest advances of ethical medicine look plain and unattractive while spreading doubt and suspicion until the best in medicine is in danger.

Federal bureaucracy has grown seven times faster than the nation's population in the past thirty-four years. The surest way to national debt and socialized medicine is to deprive individuals of the purpose of work. Oppressive taxation will achieve that goal. The Federal Government now spends 1,500 times as much on welfare as it did in 1913. Maintenance of good health is a vital part of the national security effort. One American in six is a potential beneficiary of Federal medical and hospital care.

Can the mechanism for integration and co-ordination of community resources be made a dynamic process in formulating a policy to finance medical services and hospitalization? Is it possible to define the relative responsibilities of the government and of private philanthropy to provide capital for and cost of operating these facilities? In other words, what hospital and medical problems are the responsibility of the community? Does a taxpayer have a responsibility to non-government hospitals in a community where the hospital is not tax supported? And how much of this responsibility do we want to put on the steps of government?

Protection of the nation's health is a major problem before the United States today. There is an approach toward this in the National Health Act of 1953, which was sponsored by certain members of Congress to make adequate provisions for the health and welfare of our country, and the part to be assigned to the Federal Government.

IRA H. LOCKWOOD, M.D.

ANNOUNCEMENTS AND BOOK REVIEWS

AMERICAN BOARD OF RADIOLOGY EXAMINATIONS

The deadline for filing applications for the Fall, 1954, examination by the American Board of Radiology is May 1, 1954. The examination will be held during the week of Sept. 13, 1954, in Washington, D.C.

FIFTH INTER-AMERICAN CONGRESS of RADIOLOGY

The week of April 24–29, 1955, has been set as the date for the Fifth Inter-American Congress of Radiology to be held in Washington, D. C., under the Presidency of Dr. James T. Case. Further notices of this important meeting will appear in RADIOLOGY from time to time.

GREATER MIAMI RADIOLOGICAL SOCIETY

At the January meeting of the Greater Miami (Florida) Radiological Society, the following officers were elected for the calendar year: President, Dr. E. Hampton Bryson; Vice-President, Dr. Raymond E. Parks; Secretary-Treasurer, Dr. Richard D. Shapiro, 541 Lincoln Road, Miami Beach. The Society holds monthly meetings throughout the year at various South Florida hospitals.

KENTUCKY RADIOLOGICAL SOCIETY

At its January meeting, the Kentucky Radiological Society elected the following officers for the ensuing year: President, Everett L. Pirkey, M.D., Louisville; Vice-President, Robert D. Shephard, M.D., Lexington; Secretary-Treasurer, David Shapiro, M.D., Veterans Administration Hospital, Louisville 6. Dr. Sydney E. Johnson of Louisville was elected Councilor of the American College of Radiology.

OHIO STATE RADIOLOGICAL SOCIETY

The Ohio State Radiological Society will hold its annual meeting in Toledo, Ohio, on May 22 and 23, 1954. The Society no longer meets with the State Medical Society.

RICHMOND COUNTY (GEORGIA) RADIOLOGICAL SOCIETY

At a recent meeting of the Richmond County (Georgia) Radiological Society, Col. H. R. Osheroff was elected President; Dr. Jack Levy, Vice-President; Dr. William F. Hamilton, Jr., University Hospital, Augusta, Secretary-Treasurer. Meetings are held on the first Thursday of each month.

ST. LOUIS SOCIETY OF RADIOLOGISTS

The newly elected officers of the St. Louis Society of Radiologists are: President, Donald S. Bottom. M.D.; Vice-President, Francis O. Trotter, Jr., M.D.; Secretary-Treasurer, William B. Seaman, M.D., 510 South Kingshighway, St. Louis 10.

UTAH STATE RADIOLOGICAL SOCIETY

At the annual meeting of the Utah State Radiological Society the following officers were elected to serve for the ensuing year: President, Dr. L. P. Matthei, Ogden; Vice-President, Dr. Ralph Meyer, Salt Lake City; Secretary-Treasurer, Dr. Angus K. Wilson, Salt Lake City. Meetings for 1954 are to be held on the fourth Wednesday of January, March, May, September, and November in the Conference Room of the Holy Cross Hospital. Scientific presentations will precede the business meeting.

JOSEPH FREEDMAN LECTURES

On Saturday and Sunday, April 24 and 25, 1954, Dr. Richard Schatzki, Instructor in Radiology, Harvard Medical School, and Chief Roentgenologist, Mt. Auburn Hospital, Cambridge, Mass., will deliver the Sixth Annual Joseph Freedman Lectures in Diagnostic Roentgenology at the University of Cincinnati College of Medicine. Radiologists desiring to attend may write Dr. Benjamin Felson, X-ray Department, Cincinnati General Hospital, for further details.

DR. WILLIAM H. ROBINSON HONORED

Dr. William H. Robinson of St Johnsbury, Vt., was recently honored by the St. Johnsbury Junior Chamber of Commerce, which bestowed upon him its Distinguished Service Award for his civic, religious, and professional contributions to the community. Dr. Robinson is Radiologist at the Fitch Clinic of St. Johnsbury. He is a member of the Radiological Society of North America.

HANDBOOK 56 NATIONAL BUREAU OF STANDARDS

National Bureau of Standards Handbook 56, *Safe Handling of Cadavers Containing Isotopes,*

has been prepared to provide information for the guidance of mortuary and medical personnel engaged in the handling and autopsy of cadavers containing radioactive materials. It is for sale by the Superintendent of Documents, Washington, D. C., for 15 cents.

Patients who die shortly after receiving a large internal therapeutic dose of a radioactive isotope pose problems of exposure to the pathologist and embalmer. If, however, several days elapse between treatment and death the hazard is considerably reduced, as Au^{198} decays 25 per cent, and I^{131} 9 per cent each day. Patients should be hospitalized until their isotope content is 30 mc. or less and if death occurs the body should be identified as to the amount and type of isotope present and the date of administration.

If no autopsy is performed the hazard consists mainly of gamma radiation of low intensity. Several hours after administration of 150 mc. of Au^{198} and I^{131} the surface dose rate is 1.5 and 0.4 r per hour, respectively, with a reduction to 90 per cent at 50 cm. If completed in an hour, several embalmings may be performed each week. If the body fluids are flushed into a sewer through a closed system, contamination risk is minimal.

If autopsy is to be performed, general protective measures concerning the body and gonads are applicable, but the hands require special emphasis, as they are subject to relatively intense beta radiation. No autopsy should be started on a body containing more than 5 mc. of radioactive gold or iodine without consultation with the radiation safety officer, who is responsible for protection throughout his institution.

Among the precautions prescribed are the use of double-thickness surgical rubber gloves, which reduce the dose rate to a third, and double-thickness rubber autopsy gloves, which reduce the rate to a fifth of the unshielded beta radiation. Dissections must be performed with long forceps and long handled scissors. Organs containing high concentrations of I^{131} should be removed or avoided and all organs should be stored several days before examination, if possible. All body fluids should be flushed directly into a sewer.

If injury occurs during autopsy or embalming procedures, work should be halted, the gloves washed and removed, the wound flushed in running water, a check made for residual contamination and the procedure repeated if necessary.

Laundry should be stored for a suitable decay period before washing. Instruments should be soaked in soap or a detergent and rinsed in running water. All disposable waste should be burned or flushed down a sewer and special care should be taken to prevent contamination of the autopsy room floor and spread to other parts of the institution.

Cremation, if performed without autopsy, presents no handling problem; otherwise autopsy precautions are in force. All Au^{198} and I^{131} is contained in the soft tissues and will pass out into the atmosphere, but to prevent any possible concentration at the base of the stack, cremation should not be performed if 30 mc. or more is present in the body.

OAK RIDGE INSTITUTE OF NUCLEAR STUDIES

The Special Training Division of the Oak Ridge Institute of Nuclear Studies will offer three basic isotope technics courses of four weeks each during the summer months, starting June 14, July 12, and August 9, 1954.

Additional information on the courses may be obtained from the Special Training Division of the Institute, P. O. Box 117, Oak Ridge, Tenn.

The Sixth Annual Oak Ridge Summer Symposium will be concerned this year with *Modern Analytical Chemistry*. The Symposium will be held at Oak Ridge on August 23–27. It will consist of a series of lectures by well known speakers in the field, together with several round-table discussions on certain methods in analytical chemistry.

Books Received

Books received are acknowledged under this heading, and such notice may be regarded as recognition of the courtesy of the sender. Reviews will be published in the interest of our readers and as space permits.

ATLAS OF EXFOLIATIVE CYTOLOGY. By GEORGE N. PAPANICOLAOU, M.D., Ph.D., Clinical Professor of Anatomy Emeritus, Cornell University Medical College. A loose-leaf volume of color plates and descriptive text. Published for the Commonwealth Fund by the Harvard University Press, Cambridge, Mass., 1954. Price $18.00.

SELECTED PAPERS FROM THE INSTITUTE OF CANCER RESEARCH (ROYAL CANCER HOSPITAL) AND FROM THE ROYAL CANCER HOSPITAL 1950–1951. Volume 7 containing 644 pages and numerous illustrations and tables. Published by order of the Committee of Management of the Institute and the Board of Governors of the Royal Cancer Hospital, London, 1953.

TRAITÉ DES CARDIOPATHIES CONGÉNITALES. Under the direction of E. DONZELOT, Professeur de Clinique Cardiologique à la Faculté de Medecine de Paris, Médecin de l'Hôpital Broussais, and F. D'ALLAINES, Professeur de Clinique Chirurgicale à la Faculté de Paris; Chirurgien de l'Hôpital Broussais. By R. HEIM DE BALSAC, C. MÉTIANU, M. DURAND, CH. DUBOST, M. ALLARY, N. DU BOUCHET, A.-M. EMAM-ZADÉ, J.-E. ESCALLE, B. LATSCHA, J. LE BRIGAND, and

N. OECONOMOS. A volume of 1116 pages, with 1155 illustrations. Published by Masson et Cie, Paris, 1954. Price 13,800 francs.

Book Reviews

PLANNING GUIDE FOR RADIOLOGIC INSTALLATIONS. By the Committee on Planning of Radiologic Installations of the Commission on Public Relations of the American College of Radiology, Wendell G. Scott, M.D., Chairman. A volume of 336 pages, with 102 illustrations and 93 tables. Published by The Year Book Publishers, Inc., Chicago, Ill., 1953. Price $8.00.

In response to numerous requests for an authentic source of information concerning radiologic installations, the American College of Radiology assumed the task of supplying this Planning Guide. Undertaken under the auspices of the Commission on Public Relations of the College, it was prepared by a special Committee on Planning of Radiologic Installations, of which Dr. Wendell G. Scott was chairman. Actually the work is a joint project in which radiologists, manufacturers, Federal health agencies, the American Hospital Association, and the American Institute of Architects participated. The co-operation of these groups, with their varying points of view and diverse experience, has insured a well coordinated picture, with due attention to matters of space, equipment, protection, patient traffic, film flow, etc.

All phases of radiologic practice are covered, from the simplest to the most elaborate installations for diagnosis, therapy, and radioisotope applications. The twenty-two chapters are contributed by men especially qualified by experience to present the subjects assigned to them.

This book is far more than a collection of floor plans. It is a set of working directions flexible enough to be adapted to the particular needs of any department. It will prove a valuable source of information for all those contemplating organization or revision of a radiologic department and, indeed, for any radiologist in the everyday conduct of his practice.

The printing and binding are attractive, the illustions are good, and the index adequate. Recommendations of the National Bureau of Standards on Medical X-ray Protection up to Two Million Volts, X-ray Protection Design, and Protection Against Radiations from Radium, Cobalt-60 and Cesium-137, are presented in the form of Appendixes.

MODERN TRENDS IN DIAGNOSTIC RADIOLOGY (Second Series). Edited by J. W. MCLAREN, M.A., M.R.C.P., F.F.R., D.M.R.E., Radiologist, X-Ray Department, St. Thomas' Hospital, London; Sometime Examiner in Radiology, University of London. A volume of 413 pages, with 359 illustrations. Published by Paul B. Hoeber, Inc., Medical Book Department of Harper & Bros., New York, 1953. Price $18.00.

In 1948, the first volume, or series as the publishers prefer to call it, of *Modern Trends in Diagnostic Radiology* appeared, recording and analyzing current changes in radiologic diagnosis. A second volume is now added, designed not to replace but to supplement the earlier one. While no attempt is made to cover the entire diagnostic field, as might be done in a general text, the two volumes in conjunction will be found to cover a considerable range of modern radiology.

Most of the twenty-four chapters making up the text are the work of European radiologists—Swedish (11), British (9), Norwegian (2), andD utch (1)—with a single contribution from Canada. The subject matter is diverse and cannot be given in detail here. The first fifty pages are devoted to apparatus, protection, and research. There are four chapters on angiography in its various phases, three chapters on the gastrointestinal tract and acute abdominal disease, two on the renal area, three on the spine, and single chapters on other parts of the body. A chapter relating to the legal aspects of radiologic practice concludes the volume. These chapters are the work of men generally recognized as authorities in the fields represented, and the editor places upon them the full responsibility for the views set forth.

A bibliography is appended to each chapter, and there is a general index. The text is well illustrated and the printing and binding are attractive. The work is recommended as a good compilation of interesting material on many diverse phases of radiologic diagnosis.

THE PHYSICIAN IN ATOMIC DEFENSE. ATOMIC PRINCIPLES, BIOLOGIC REACTION AND ORGANIZATION FOR MEDICAL DEFENSE. By THAD P. SEARS M.D., F.A.C.P., Associate Clinical Professor of Medicine, University of Colorado School of Medicine; Chief of Medical Service, Veterans Administration Hospital, Denver; Member of Advisory Staff to Director of Civil Defense, State of Colorado; Member of Disaster Commission, Colorado State Medical Society; Colonel (M.C.), U.S.A.R. With a Foreword by JAMES J. WARING, M.D., M.A.C.P., Professor of Medicine, University of Colorado School of Medicine. A volume of 308 pages, with 53 illustrations. Published by the Year Book Publishers, Inc., Chicago, Ill., 1953. Price $6.00.

The author of this work has set out to put down in readable form the basic information about nuclear physics and its impact on civilian populations in the course of war. He has avoided, as far as possible, complicated formulas and descriptions, so that one may be informed without being hopelessly involved in physics.

The book is divided into three Sections. Section I covers most of the non-medical aspects of the subject, being devoted to background information on the atomic theory, basic physics, and atomic bombs. Section II takes up the clinical, biologic, pathologic, and therapeutic aspects of atomic warfare and includes discussions of radiation sickness, biologic reactions, effects of total-body irradiation, management of casualties, and detection instrumentation. Section III gives much needed detailed plans for defense against atomic warfare. It includes chapters on civil defense organization, the medical services, public health aspects, and, specifically, radiologic defense.

This book is recommended for all civil defense-minded individuals. It deserves a wide distribution.

FUNDAMENTALS OF CLINICAL ORTHOPEDICS. By PETER A. CASAGRANDE. M.D., Orthopedic Department of Buffalo General Hospital, Buffalo Children's Hospital, and the University of Buffalo Medical School; Attending Orthopedist at the Chronic Disease Research Institute of the University of Buffalo, and the Veterans Administration Hospital, Buffalo, N. Y., and HAROLD M. FROST, JR., M.D., Orthopedic Department of Buffalo General Hospital and the University of Buffalo Medical School, Buffalo, N. Y. Forewords by JOSEPH S. BARR, M.D., and FRANK N. POTTS, M.D. A volume of 582 pages, with 390 illustrations. Published by Grune & Stratton, Inc., New York, N. Y., 1953. Price $18.50.

It is unusual for a book to be presented which is of such value that its advent is welcome. The appearance of a "new" work on orthopedic surgery is always received skeptically. "Fundamentals of Clinical Orthopedics" was so received when it first reached the reviewer's desk, but a brief introductory investigation aroused our enthusiasm, and by the time we had used this book as a reference for a short time we came to appreciate it greatly. This is not just another "textbook" but is actually a concentration of the salient features of orthopedic surgery presented in so readable a style that it offers the student—specialist or beginner—a close approximation of "knowledge gained in pill form."

The Index is excellent, as is the Table of Contents, and both of these are essential in a reference book if it is to be of any value. Certain divisions of the book are exceptionally good, such as that concerning congenital affections of the musculoskeletal system. The radiologic data presented are unusual for several reasons. Illustrative roentgenograms are numerous but not excessive and are reproduced unusually well, so that the salient features are clearly demonstrable. Another valuable feature is the presentation of photographs of the clinical condition to accompany the films.

It is regrettable that no bibliography is included, since some of the statements appearing in the text are not acceptable to all orthopedic surgeons, and it would be of help to pursue interesting subjects further. Also the sections on "basic science" are perhaps too superficial to be of real value to either the student or specialist. But certainly this is a book that all who deal with affections of the musculoskeletal system—student, general practitioner, orthopedic surgeon, and radiologist—should have readily available, preferably in his own office.

RADIATIONS AND LIVING CELLS. AN INTRODUCTION TO RADIATION BIOLOGY, IN WHICH THE ACTION OF PENETRATING RADIATIONS ON THE LIVING CELL IS DESCRIBED, WITH SPECIAL REFERENCE TO THE EFFECT ON CELL DIVISION IN HUMAN TISSUES. By F. G. SPEAR, M.D., M.A., D.M.R.E., Member Scientific Staff, Medical Research Council, Strangeways Research Laboratory, Cambridge. A volume of 222 pages, with 60 illustrations. Published by John Wiley & Sons, Inc., New York, N. Y., 1953. Price $3.50.

In a small compact book, well and concisely written, the author seeks to bridge the gap between medical physics and radiation biology. In the early chapters he deals with the history of radiology and radiation, biology, cell structure, division, and repair, the place of the cell in tissue formation, and the types of biological response to ionizing radiation. Succeeding chapters describe in detail the effects of radiation on specific systems of the human body—the alimentary canal, the circulatory system, the generative system—whole-body irradiation, and atomic energy as a source of penetrating radiation. Single chapters are devoted to radiation and cancer and to theories concerning the mechanism of action of radiation on living cells.

A list of references, a bibliography, and name and subject indexes complete this little volume, which is legibly printed and nicely illustrated.

In Memoriam

JAMES HUBERT WEST, M.D.

Dr. James Hubert West died in Tucson, Ariz., on Jan. 8, 1954. He was born in Tiffin, Ohio, in 1887. After graduating from Wooster College, Ohio, he received his degree in medicine from Western Reserve University in 1915, served his internship at St. Vincent's Charity Hospital, Cleveland, and took postgraduate courses in radiology at the University of Pennsylvania.

Returning to Cleveland, Dr. West was associated with Dr. John D. Osmond, Sr., from 1923 to 1947. In 1916 he was commissioned first lieutenant and served with an Ohio National Guard Unit at Fort Bliss. In July 1917, he was discharged for physical disability. In 1947 he moved to Tucson to become associated with Dr. A. Ludwig Lindberg at the Tucson Tumor Clinic, specializing in therapeutic radiology.

Dr. West was a member of the American Medical Association and, while in Cleveland, of the Ohio State Medical Association and of the Cleveland Academy of Medicine. He was a charter member of the Cleveland Radiological Society. He was a member, also, of the Radiological Society of North America and a Life Fellow of the American College of Radiology. After going to Tucson he became a member of the Arizona State Medical Association, Pima County Medical Society, and the Arizona State Radiological Society. He served on the staffs of St. Mary's Hospital, Tucson Medical Center Hospital, and Pima County General Hospital until his retirement from active practice in July 1953.

Immediate survivors include his wife, Rena Richey West, a sister Margaret A. West, of Tiffin, Ohio, and a brother, R. K. West, of Great Falls, Mont.

Several years ago, Dr. West realized the seriousness of his cardiac condition. He became amazingly philosophical about it and did not let it deter him from courageously carrying on his practice until the last few months of his life, when he became totally incapacitated. He had the confidence and affection of his patients and the respect of his professional colleagues.

U. V. PORTMAN, M.D.

RADIOLOGICAL SOCIETIES: SECRETARIES AND MEETING DATES

Editor's Note: Secretaries of state and local radiological societies are requested to co-operate in keeping this section up-to-date by notifying the editor promptly of changes in officers and meeting dates.

RADIOLOGICAL SOCIETY OF NORTH AMERICA. *Secretary-Treasurer*, Donald S. Childs, M.D., 713 E. Genesee St., Syracuse 2, N. Y.

AMERICAN RADIUM SOCIETY. *Secretary*, Robert E. Fricke, M.D., Mayo Clinic, Rochester, Minn.

AMERICAN ROENTGEN RAY SOCIETY. *Secretary*, Barton R. Young, M.D., Germantown Hospital, Philadelphia 44, Penna.

AMERICAN COLLEGE OF RADIOLOGY. *Exec. Secretary*, William C. Stronach, 20 N. Wacker Dr., Chicago 6.

SECTION ON RADIOLOGY, A. M. A. *Secretary*, Paul C. Hodges, M.D., 950 East 59th St., Chicago 37.

Alabama

ALABAMA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, J. A. Meadows, Jr., M.D., Medical Arts Bldg., Birmingham 5.

Arizona

ARIZONA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, R. Lee Foster, M.D., 507 Professional Bldg., Phoenix. Annual meeting with State Medical Association; interim meeting in December.

Arkansas

ARKANSAS RADIOLOGICAL SOCIETY. *Secretary*, Fred Hames, M.D., Pine Bluff. Meets every three months and at meeting of State Medical Society.

California

CALIFORNIA MEDICAL ASSOCIATION, SECTION ON RADIOLOGY. *Secretary*, H. R. Morris, M.D., 1027 D St., San Bernardino.

EAST BAY ROENTGEN SOCIETY. *Secretary*, Dan Tucker, M.D., 434 30th St., Oakland 9. Meets monthly, first Thursday, at Peralta Hospital.

LOS ANGELES RADIOLOGICAL SOCIETY. *Secretary*, George Jacobson, M.D., 1200 North State St., Los Angeles 33. Meets monthly, second Wednesday, Los Angeles County Medical Association Bldg.

NORTHERN CALIFORNIA RADIOLOGICAL CLUB. *Secretary*, H. B. Stewart, Jr., M.D., 2920 Capitol Ave., Sacramento. Meets last Monday of each month, September to May.

PACIFIC ROENTGEN SOCIETY. *Secretary*, L. Henry Garland, M.D., 450 Sutter St., San Francisco 8. Meets annually at time of California State Medical Association convention.

RADIOLOGICAL SOCIETY OF SOUTHERN CALIFORNIA. *Secretary-Treasurer*, Donald R. Laing, M.D., 65 North Madison Ave., Pasadena 1.

SAN DIEGO RADIOLOGICAL SOCIETY. *Secretary*, C. W. Bruner, M.D., 2456 Fourth Ave., San Diego 1. Meets first Wednesday of each month.

SAN FRANCISCO RADIOLOGICAL SOCIETY. *Secretary*, I. J. Miller, M.D., 2680 Ocean Ave., San Francisco 27. Meets quarterly, at the University Club.

SOUTH BAY RADIOLOGICAL SOCIETY. *Secretary*, James J. McCort, M.D., Santa Clara County Hospital, San Jose-Los Gatos Road, San Jose. Meets monthly, second Wednesday.

X-RAY STUDY CLUB OF SAN FRANCISCO. *Secretary*, Wm. W. Saunders, M.D., VA Hospital, San Francisco 21. Meets third Thursday at 7:45, Lane Hall, Stanford University Hospital.

Colorado

COLORADO RADIOLOGICAL SOCIETY. *Secretary*, Parker Allen, M.D., Children's Hospital, Denver. Meets monthly, third Friday, at University of Colorado Medical Center or Denver Athletic Club.

Connecticut

CONNECTICUT STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary-Treasurer*, William A. Goodrich, M.D., 85 Jefferson St., Hartford 14. Meets bimonthly, second Wednesday.

CONNECTICUT VALLEY RADIOLOGICAL SOCIETY. *Secretary*, B. Bruce Alicandri, M.D., 20 Maple St., Springfield, Mass. Meets second Friday of October and April.

District of Columbia

RADIOLOGICAL SECTION, DISTRICT OF COLUMBIA MEDICAL SOCIETY. *Secretary*, Alvin C. Wyman, M.D., 5445 28th St., N.W., Washington. Meets third Wednesday, January, March, May, and October, at 8:00 P.M., in Medical Society Library.

Florida

FLORIDA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Hugh G. Reaves, M.D., Medical Arts Bldg., Sarasota. Meets in April and in October.

GREATER MIAMI RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Richard D. Shapiro, M.D., 541 Lincoln Road, Miami Beach. Meets monthly, third Wednesday, 8:00 P.M.

Georgia

ATLANTA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Albert A. Rayle, Jr., M.D., 490 Peachtree St. Meets second Friday, September to May.

GEORGIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Robert M. Tankesley, M.D., 218 Doctors Bldg., Atlanta. Meets in November and at the annual meeting of the State Medical Association.

RICHMOND COUNTY RADIOLOGICAL SOCIETY. *Secretary*, Wm. F. Hamilton, Jr., M.D., University Hospital, Augusta. Meets first Thursday of each month.

Hawaii

RADIOLOGICAL SOCIETY OF HAWAII. *Secretary*, Philip S. Arthur, M.D., Suite 42, Young Hotel Bldg., Honolulu. Meets third Friday of each month.

Illinois

CHICAGO ROENTGEN SOCIETY. *Secretary*, Elbert K. Lewis, M.D., 6337 S. Harvard Ave., Chicago 21. Meets at the University Club, second Thursday of October, November, January, February, March, and April at 8:00 P.M.

ILLINOIS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Stephen L. Casper, M.D., Physicians and Surgeons Clinic, Quincy.

ILLINOIS STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary*, George E. Irwin, Jr., M.D., 427 N. Main St., Bloomington.

Indiana

INDIANA ROENTGEN SOCIETY. *Secretary-Treasurer*, John A. Robb, M.D., 23 East Ohio St., Indianapolis. Annual meeting in May.

Iowa

IOWA RADIOLOGICAL SOCIETY. *Secretary*, James T. McMillan, M.D., 1104 Bankers Trust Bldg., Des Moines. Meets during annual session of State Medical Society, and holds a scientific session in the Fall.

Kansas

KANSAS RADIOLOGICAL SOCIETY. *Secretary*, Willis L. Beller, M.D., 700 Kansas Ave., Topeka. Meets in the Spring with the State Medical Society and in the Winter on call.

Kentucky

KENTUCKY RADIOLOGICAL SOCIETY. *Secretary*, David Shapiro, M.D., Veterans Administration Hospital, Louisville 6. Meets monthly, second Friday, at Seelbach Hotel, Louisville.

Louisiana

ORLEANS PARISH RADIOLOGICAL SOCIETY. *Secretary*, Joseph V. Schlosser, M.D., Charity Hospital of Louisiana, New Orleans 13. Meets second Tuesday of each month.

RADIOLOGICAL SOCIETY OF LOUISIANA. *Secretary-Treasurer*, J. T. Brierre, M.D., 700 Audubon Bldg., New Orleans.

SHREVEPORT RADIOLOGICAL CLUB. *Secretary*, W. R. Harwell, M.D., 608 Travis St. Meets monthly, September to May, third Wednesday.

Maine

MAINE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Jack Spencer, M.D., Maine General Hospital, Portland 4. Meets three times a year—Spring, Summer, and Fall.

Maryland

BALTIMORE CITY MEDICAL SOCIETY, RADIOLOGICAL SECTION. *Secretary-Treasurer*, H. Leonard Warres, M.D., 2337 Eutaw Place, Baltimore 17. Meets third Tuesday, September to May.

MARYLAND RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, H. Leonard Warres, M.D., 2337 Eutaw Place, Baltimore 17.

Michigan

DETROIT X-RAY AND RADIUM SOCIETY. *Secretary*, E. F. Lang, M.D., Harper Hospital, Detroit 1. Meets first Thursday, October to May, at Wayne County Medical Society club rooms.

Minnesota

MINNESOTA RADIOLOGICAL SOCIETY. *Secretary*, John R. Hodgson, M.D., The Mayo Clinic, Rochester. Meets in Spring and Fall.

Mississippi

MISSISSIPPI RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John W. Evans, M.D., 117 N. President St., Jackson, Miss. Meets monthly, third Tuesday, at 6:30 P.M., at the Rotisserie Restaurant, Jackson.

Missouri

RADIOLOGICAL SOCIETY OF GREATER KANSAS CITY. *Secretary*, James E. McConchie, M.D., First National Bank Bldg., Independence, Mo. Meets last Friday of each month.

ST. LOUIS SOCIETY OF RADIOLOGISTS. *Secretary*, Wm. B. Seaman, M.D., 510 South Kingshighway, St. Louis 10. Meets on fourth Wednesday, October to May.

Montana

MONTANA RADIOLOGICAL SOCIETY. *Secretary*, Grant P. Raitt, M.D., 413 Medical Arts Bldg., Billings. Meets annually.

Nebraska

NEBRASKA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, James F. Kelly, Jr., M.D., 816 Medical Arts Bldg., Omaha. Meets third Wednesday of each month at 6 P.M. in Omaha or Lincoln.

New England

NEW ENGLAND ROENTGEN RAY SOCIETY. *Secretary*, Stanley M. Wyman, M.D., Massachusetts General Hospital, Boston 14. Meets monthly on third Friday, at the Harvard Club, Boston.

New Hampshire

NEW HAMPSHIRE ROENTGEN SOCIETY. *Secretary*, Albert C. Johnston, M.D., 127 Washington St., Keene.

New Jersey

RADIOLOGICAL SOCIETY OF NEW JERSEY. *Secretary*, Salomon Silvera, M.D., 921 Bergen Ave., Jersey City. Meets at Atlantic City at time of State Medical Society and midwinter in Elizabeth.

New York

BUFFALO RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Mario C. Gian, M.D., 610 Niagara St., Buffalo 1. Meets second Monday, October to May.

CENTRAL NEW YORK ROENTGEN SOCIETY. *Secretary*, Dwight V. Needham, M.D., 608 E. Genesee St., Syracuse 2. Meets in January, May, and October.

KINGS COUNTY RADIOLOGICAL SOCIETY. *Secretary*, Solomon Maranov, M.D., 1450 51st St., Brooklyn 19. Meets fourth Thursday, October to April (except December), at 9:00 P.M., Kings County Medical Bldg.

NASSAU RADIOLOGICAL SOCIETY. *Secretary*, Frank Huber, M.D., 131 Fulton Ave., Hempstead, N. Y. Meets second Tuesday, February, April, June, October, and December.

NEW YORK ROENTGEN SOCIETY. *Secretary*, Jacob R. Freid, M.D., 1049 Park Ave., New York.

NORTHEASTERN NEW YORK RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Donald H. Baxter, M.D., Albany Hospital, Albany. Meets in the capital area second Wednesday, October, November, March, and April. Annual meeting in May or June.

RADIOLOGICAL SOCIETY OF NEW YORK STATE. *Secretary-Treasurer*, Mario C. Gian, M.D., 610 Niagara St., Buffalo. Meets annually with the State Medical Society.

ROCHESTER ROENTGEN-RAY SOCIETY. *Secretary-Treasurer*, Henry H. Forsyth, Jr., M.D., 40 Meigs St., Rochester 7. Meets at Strong Memorial Hospital, 8:15 P.M., last Monday of each month, September through May.

WESTCHESTER RADIOLOGICAL SOCIETY. *Secretary*, Charles G. Huntington, M.D., 170 Maple Ave., White Plains, N. Y. Meets third Tuesday of January and October and at other times as announced.

North Carolina

RADIOLOGICAL SOCIETY OF NORTH CAROLINA. *Secretary*, Waldemar C. A. Sternbergh, M.D., 1400 Scott Ave., Charlotte 2. Meets in April and October.

North Dakota

NORTH DAKOTA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, H. Milton Berg, M.D., Quain & Ramstad Clinic, Bismarck. Meets in the Spring with State Medical Association; in Fall or Winter on call.

Ohio

OHIO STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, M. M. Thompson, Jr., M.D., 316 Michigan St., Toledo.

CENTRAL OHIO RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Howard W. Bangs, 1381 West Sixth Ave., Columbus 12. Meets second Thursday, October, December, February, April, and June, 6:30 P.M., Columbus Athletic Club, Columbus.

CLEVELAND RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Mortimer Lubert, M.D., Heights Medical Center Bldg., Cleveland Heights 6. Meets at 6:45 P.M. on fourth Monday, October to April, inclusive.

GREATER CINCINNATI RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Chapin Hawley, M.D., 927 Carew Tower, Cincinnati 2. Meets first Monday of each month, September to June, at Cincinnati General Hospital.

MIAMI VALLEY RADIOLOGICAL SOCIETY. *Secretary*, W. S. Koller, M.D., 60 Wyoming St., Dayton. Meets monthly, second Friday.

Oklahoma

OKLAHOMA STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John R. Danstrom, M.D., Medical Arts Bldg., Oklahoma City.

Oregon

OREGON RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John Wayne Loomis, M.D., 919 Taylor Street Bldg., Portland 5. Meets monthly, second Wednesday, October to June, at 8:00 P.M., University Club, Portland.

Pacific Northwest

PACIFIC NORTHWEST RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Sydney J. Hawley, M.D., 1320 Madison St., Seattle 4. Meets annually in May.

Pennsylvania

PENNSYLVANIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, James M. Converse, M.D., 416 Pine St., Williamsport 8. Meets annually.

PHILADELPHIA ROENTGEN RAY SOCIETY. *Secretary*, Herbert M. Stauffer, M.D., Temple University Hospital, Philadelphia 40. Meets first Thursday of each month at 5:00 P.M., from October to May, in Thompson Hall, College of Physicians.

PITTSBURGH ROENTGEN SOCIETY. *Secretary-Treasurer*, Donald H. Rice, M.D., 4800 Friendship Ave., Pittsburgh 24. Meets monthly, second Wednesday, at 6:30 P.M., October to May, at Webster Hall.

Rocky Mountain States

ROCKY MOUNTAIN RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John H. Freed, M.D., 4200 East Ninth Ave., Denver 7, Colo.

South Carolina

SOUTH CAROLINA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*. William A. Klauber, M.D., Self Memorial Hospital, Greenwood. Meets with State Medical Association in May.

South Dakota

RADIOLOGICAL SOCIETY OF SOUTH DAKOTA. *Secretary-Treasurer*, Donald J. Peik, M.D., 303 S. Minnesota Ave., Sioux Falls. Meets during annual meeting of State Medical Society.

Tennessee

MEMPHIS ROENTGEN CLUB. *Secretary*, Harvey Thompson, M.D., 899 Madison Ave. Meets first Monday of each month at John Gaston Hospital.

TENNESSEE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, George K. Henshall, M.D., 311 Medical Arts Bldg., Chattanooga 3. Meets annually with State Medical Society in April.

Texas

DALLAS-FORT WORTH ROENTGEN STUDY CLUB. *Secretary*, Otto H. Grunow, M.D., 650 Fifth Ave., Fort Worth 4, Texas. Meets monthly, third Monday 6:30 P.M., at the Greater Fort Worth International Airport.

HOUSTON RADIOLOGICAL SOCIETY. *Secretary*, Harry Fishbein, M.D., 324 Medical Arts Bldg., Houston 2.

SAN ANTONIO-MILITARY RADIOLOGICAL SOCIETY. *Secretary*, Hugo F. Elmendorf, Jr., M.D., 730 Medical Arts Building, San Antonio 5, Texas. Meets at Brook Army Medical Center, the first Monday of each month.

TEXAS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, R. P. O'Bannon, M.D., 650 Fifth Ave., Fort Worth. Next meeting Jan. 29–30, 1954, Dallas.

Utah

UTAH STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Angus K. Wilson, M.D., 343 S. Main St., Salt Lake City 1. Meets third Wednesday, January, March, May, September, November.

Virginia

VIRGINIA RADIOLOGICAL SOCIETY. *Secretary*, P. B. Parsons, M.D., 1308 Manteo St., Norfolk 7.

Washington

WASHINGTON STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Eva L. Gilbertson, M.D., 1317 Marion St., Seattle 4. Meets fourth Monday, September through May, at 610 Pine St., Seattle.

West Virginia

WEST VIRGINIA RADIOLOGICAL SOCIETY. *Secretary*, W. Paul Elkin, 515–519, Medical Arts Bldg., Charleston. Meets concurrently with annual meeting of State Medical Society, and at other times as arranged by Program Committee.

Wisconsin

MILWAUKEE ROENTGEN RAY SOCIETY. *Secretary-Treasurer*, Jerome L. Marks, M.D., 161 W. Wisconsin Ave., Milwaukee 1. Meets monthly on fourth Monday at the University Club.

SECTION ON RADIOLOGY, STATE MEDICAL SOCIETY OF WISCONSIN. *Secretary*, Abraham Melamed, M.D., 425 E. Wisconsin Ave., Milwaukee 2. Meets in October with State Medical Society.

UNIVERSITY OF WISCONSIN RADIOLOGICAL CONFERENCE. Meets first and third Thursday at 4 P.M., September to May, Service Memorial Institute.

WISCONSIN RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, W. W. Moir, M.D., Sheboygan Memorial Hospital, Sheboygan.

Puerto Rico

ASOCIACIÓN PUERTORRIQUEÑA DE RADIOLOGÍA. *Secretary*, Rafael A. Blanes, M.D., Box 9724 Santurce, Puerto Rico.

CANADA

CANADIAN ASSOCIATION OF RADIOLOGISTS. *Honorary Secretary-Treasurer*, D. L. McRae, M.D., *Assoc. Hon. Secretary-Treasurer*, Guillaume Gill, M.D. *Central Office*, 1555 Summerhill Ave., Montreal 25, Quebec. Meets in January and June.

LA SOCIÉTÉ CANADIENNE-FRANÇAISE D'ELECTROLOGIE ET DE RADIOLOGIE MÉDICALES. *General Secretary*, Origène Dufresne, M.D., Institut du Radium, Montreal. Meets third Saturday of each month.

CUBA

SOCIEDAD DE RADIOLOGÍA Y FISIOTERAPÍA DE CUBA. *Secretary*, Dr. Rafael Gómez Zaldívar. Offices in Hospital Mercedes, Havana. Meets monthly.

MEXICO

SOCIEDAD MEXICANA DE RADIOLOGÍA Y FISIOTERAPÍA. *General Secretary*, Dr. Dionisio Pérez Cosio, Marsella 11, Mexico, D. F. Meets first Monday of each month.

PANAMA

SOCIEDAD RADIOLÓGICA PANAMEÑA. *Secretary-Editor*, Luis Arrieta Sánchez, M.D., Apartado No. 86, Panama, R. de P.

ABSTRACTS OF CURRENT LITERATURE

ROENTGEN DIAGNOSIS

The Head and Neck

LAST, R. J., AND TOMPSETT, D. H. Casts of the Cerebral Ventricles 442

RUGGIERO, GIOVANNI, AND CASTELLANO, FRANCESCO. Upward Displacement of the Posterior Part of the Third Ventricle. A Method for Its Evaluation 442

POPPEN, JAMES L., ET AL. Colloid Cysts of the Third Ventricle. Seven Cases 442

BAKAY, LOUIS, AND WHITE, JAMES C. Pneumoencephalography in Chromophobe Adenomas of the Hypophysis 443

HARRISON, CLINTON R., AND LUTTRELL, CHARLES. Persistent Carotid-Basilar Anastomosis. Three Arteriographically Demonstrated Cases with One Anatomical Specimen 443

PSENNER, L. Some Rare Diseases of the Maxillary Sinus 443

NICHOLS, GREGORY B. An Inexpensive Semi-Automatic Serialographic Apparatus for Angiography 444

The Chest

RIMINI, RICARDO, ET AL. Contribution of Angiopneumography to Some Problems of Pulmonary Physiopathology 444

FELTON, WARREN L., II. The Reaction of Pulmonary Tissue to Lipiodol 444

SVOBODA, MILAN. Bronchography with Joduron B 444

HOLVI, YURYI, AND POCH, ROBERT. Deformity of the Bronchi 445

SMITH, MARCUS J. Roentgenographic Aspects of Complete and Incomplete Pulmonary Infarction 445

REISS, JACK, ET AL. The Early Recognition and Treatment of Bronchogenic Carcinoma 445

BRINDLEY, G. V., JR. Bronchogenic Carcinoma Simulating Benign Pulmonary Disease 445

DELARUE, J., ET AL. Association of Tuberculosis and Primary Bronchogenic Cancers 446

SKOKAN, ZDENĚK V. Thoracic Sympathicoblastoma Simulating an Intrapulmonary Tumor 446

DEUTSCHBERGER, OTTO, ET AL. An Unusual Case of Intrathoracic Fibroma Associated with Pulmonary Hypertrophic Osteoarthropathy. 446

JONES, W. A. The Solitary Pulmonary Focus—Carcinomatous or Otherwise, with Particular Reference to Histoplasmosis 446

REINHARDT, K. Concerning a Case of Pulmonary Lymphangiectasis 447

MURPHY, DOREEN. Lung Cyst in Infancy 447

ZIMMERMAN, JACOB, ET AL. An Evaluation of Extrapleural Pneumonolysis Based on a Follow-up Study of Seventy Cases with Lucite Plombage 447

HAMLIN, L. E. Anthracosilicosis Occurring in a Foundry Employee 447

LELL, WILLIAM A. Tracheopathia Osteoplastica. Case 448

NISSEN, RUDOLPH, ET AL. Osteochondroma of the Bronchus 448

RUSHMER, ROBERT F., ET AL. Cinefluorographic Studies of Cardiovascular Disease 448

MOROS G., GUSTAVO, ET AL. Fluorodensography with Radiopaque Substance. A New Method for Hemodynamic Investigation 448

Report of Committee (of American Heart Association) on Cardiac Catheterization and Angiocardiography 449

LOGAN, ANDREW, AND TURNER, RICHARD. Mitral Stenosis. Diagnosis and Treatment ... 449

WYMAN, ALVIN C. Roentgenologic Diagnosis of Traumatic Rupture of the Thoracic Aorta .. 449

GOETZ, R. H., AND NELLEN, MAURICE. Idiopathic Dilatation of the Pulmonary Artery .. 450

The Diaphragm

STRODE, ERNEST C., AND VANCE, CHARLES A. Herniation of Right Diaphragm Secondary to Trauma 450

AXLER, MORTON M., AND REHERMANN, ROBERT L. Partial Eventration of Right Diaphragm 450

VĚŠÍN, SLAVOJ. Roentgenologic Symptomatology of Diaphragmatic Tumors 450

The Digestive System

PIRKEY, EVERETT L., ET AL. Non-Malignant Roentgen Changes in the Gastro-Intestinal Tract Associated with Aging 451

NANSON, E. M., AND WALKER, R. MILNES. Partial Spontaneous Rupture of the Oesophagus 451

MELAMED, A., AND MARCK, A. Esophageal Obstruction Due to Serutan 451

OLSEN, ARTHUR M., ET AL. Diagnosis of Cardiospasm 451

FÓTI, M. Roentgen Examination of the Stomach with Tetraethylammoniumbromide (TEAB). A New Pharmacodynamic Procedure 452

LILJA, BENGT. Gastric Block. A Disturbance in Gastric Motive Function 452

SVOBODA, MILAN. Torsion of the Stomach 452

MATZINGER, K. E. Gastric Diverticula 452

ANTONIE, T. Myoma of the Stomach. A Review of 50 Cases 453

STEEN, LOWELL H., AND NEWELL, W. G. Calcified Gastric Leiomyoma 453

SILK, ARTHUR D., ET AL. Ulcer of the Greater Gastric Curvature 453

BLOCK, WALTER M. Chronic Gastric Ulcer in Childhood 453

CHAIKEN, BERNARD H., ET AL. Coexistence of Peptic Ulcer and Idiopathic Ulcerative Colitis 454

SHIELDS, W. E., ET AL. Peptic Ulcer Perforation Following Administration of Phenylbutazone 454
RAFFENSPERGER, EDWARD C. Multiple Gastric Ulcers Occurring During Phenylbutazone Therapy 454
KRAININ, PHILIP. Gastric Ulcer with Massive Hemorrhage Following Use of Phenylbutazone 454
BOSIEN, WILLIAM R., AND TYSON, M. DAWSON. Spontaneous Perforation of a Benign Gastric Ulcer into the Transverse Colon 454
MCCUNE, WILLIAM S., AND KESHISHIAN, JOHN M. Postoperative Intestinal Obstruction 454
BECK, WILLIAM C., AND CHOHANY, GEORGE. Duodenal Atresia 455
OLNICK, HERBERT M., AND WATKINS, WILLIAM M. Barium Peritonitis 455
SACHS, MAURICE D. Visualization of the Common Duct During Cholecystography: Its Significance 455

The Musculoskeletal System

PARKER, LEON O., AND DELORIMIER, ALFRED A. Double Contrast Visualization of Joints 455
SILVERMAN, FREDERIC N. Roentgen Manifestations of Unrecognized Skeletal Trauma in Infants 456
EVANS, JOHN. Leontiasis Ossea. A Critical Review, with Reports of Four Original Cases 456
MAŘATKA, ZDENĚK, AND STŘEDA, ADOLF. Generalized Hyperostosis and Pachyderma 457
BERREY, BEDFORD H., AND KIMBALL, CECIL H. Chondrodystrophia Calcificans Congenita 457
GOLDEN, G. N., AND RICHARDS, H. G. H. Xanthogranulomatous Disease of Bone with Polyarthritis. Two Cases 457
HEYMANN, SEYMOUR, ET AL. Septic Arthritis and Osteomyelitis in Infancy 458
JENKINS, MELVIN E., AND SCOTT, ROLAND B. Infantile Cortical Hyperostosis. Case in a Negro Infant 458
BRAUNWARTH, K. Simultaneous Occurrence of Fibrous Dysplasia and Extra-Osseous Fibromyxomata 458
FIETZ, H. Rare Dislocations and Fracture-Dislocations 459
DE LORIMIER, A. A. Arthropathies of the Temporomandibular Joint 459
GREGOR, Z., AND KOVÁŘOVÁ, M. Contribution to Congenital Syphilis 460
TANZ, STANLEY S. Motion of the Lumbar Spine. A Roentgenologic Study 460
BUETTI, C. Roentgen Diagnosis of Rare Malformations of the Cervical Spine 460
REDO, S. FRANK. Spinal Complications Following Lumbar Puncture. A Review of the Literature and Report of Four Cases 461
STEIN, FELIX, ET AL. Nontraumatic Subluxation of the Atlanto-Axial Articulation 461
BAYLIN, GEORGE J., AND WEAR, JOHN M. Blastomycosis and Actinomycosis of the Spine 461
DE HAENE, R. Concerning Eighty Disk Opacifications. Interest and Indications of Discography 462
LAURENCE, W., AND FRANKLIN, E. L. Calcifying Enchondroma of Long Bones 462
MORRISON, A. B. The Os Paracuneiforme. Some Observations on an Example Removed at Operation 462
SCHOEN, DETLEV. The Torn Achilles Tendon in the Roentgenogram 462

The Genitourinary System

ROTHFELD, SAMUEL H., ET AL. Perirenal Air Insufflation by Paracoccygeal Method 463
BERSACK, SOLOMON R., AND WHITAKER, THOMAS E., JR. Effect of Diphenhydramine (Benadryl®) on Side-Reactions in Intravenous Urography 463
LATTIMER, JOHN K. A Roentgenographic Classification of Tuberculous Lesions of the Kidney 463
REAY, E. R., AND ROLLESTON, G. L. Hydatid Cyst of the Kidney. Two Cases 464
PEREIRA, ATHAYDE. Roentgen Interpretation of Vesiculograms 464
SCHUMANN, E. Roentgen Examination for the Differentiation of Simple Hypospadias from Hypospadias Associated with Hermaphroditism 464
PRATHER, GEORGE C., AND SINGISER, JAMES A. Urological Importance of Radiopaque Appendiceal Concretions 465

The Blood Vessels

WESSLER, STANFORD, AND SCHLESINGER, MONROE J. Studies in Peripheral Arterial Occlusive Disease. I. Methods and Pathologic Findings in Amputated Limbs 465
SCHOEN, DETLEV. Selective Arteriography 465
KNOX, W. GRAHAM, AND PARSONS, HERBERT. Sympathectomy in Chronic Occlusive Arterial Disease 466
SELDINGER, SVEN IVAR. Catheter Replacement of the Needle in Percutaneous Arteriography 466
LEGER, L., ET AL. Portal Phlebography by Transparietal Parenchymatous Splenic Injection 466

Miscellaneous

MERCER, ROBERT D., ET AL. Clinical Diagnosis of Generalized Cytomegalic Inclusion Disease 466

RADIOTHERAPY

BOLKER, NORMAN. Nitrogen Balance in Malignant Disease 467
KÖRBLER, J., ET AL. Radium Treatment of Cutaneous and Lip Cancer 467
WILSON, WESLEY W. X-Ray Therapy in the Treatment of Hemangiomas 467
LANGLEY, RUSSELL A. Simple Scheme for Deriving X-Ray Skin-Surface Dose Times 467

DINNING, T. A. R. Osteoclastoma of the Petrous Temporal Bone. Case Benefited by Deep X-Ray Therapy 468
WELIN, SÖLVE. The Roentgenologic Diagnosis and Follow-up of Hypopharyngeal Cancer .. 468
CLIFFTON, EUGENE E., AND BLANSFIELD, HENRY N. Treatment of Carcinoma of the Esophagus by Radiation Therapy and Surgery 468
ASH, C. L., ET AL. The Argument for Preoperative Radiation in Breast Cancer 469
EBERHARD, THEODORE P. Radium in the Treatment of Cancer of the Tongue 469
MEIGS, JOE VINCENT. Carcinoma of the Cervix—An Experience with the Surgical Treatment 470
EYMER, HEINRICH, AND RIES, JULIUS. Results of Radiation Therapy of Carcinoma of the Cervix at the I. Gynecological Clinic of the University of Munich in 1945 and 1946 470
REICHENMILLER, H., AND DRESCHER, H. Is the Five-Year Cure of Carcinoma of the Cervix a Permanent Cure? 470
McGARRITY, K. A. Value of Serial Biopsies Following Irradiation of Carcinoma of the Cervix 471
SCHWARTZ, JEROME, AND NARDIELLO, VINCENT. Furacin Vaginal Suppositories. Their Use with Radiation Therapy for Malignant Pelvic Neoplasms 471
COOKE, JEAN V. Chronic Myelogenous Leukemia in Children 471
FRIED, CARL. Roentgen Irradiation of Uveitis .. 471
JOHNS, H. E., ET AL. A System of Dosimetry for Rotation Therapy with Typical Rotation Distributions 472

RADIOISOTOPES

GREEN, D. T., ET AL. Production of Multicurie Gamma-Ray Teletherapy Sources 472
TUDWAY, ROBERT C. The Use of Radio-Active Isotopes in an Applicator for the Treatment of Carcinoma of the Cervix Uteri 472
MORTON, JOSEPH L. Irradiation of Cancer of the Uterine Cervix with Radioactive Cobalt 60 in Guided Aluminum Needles and in Plastic Threads 473
JAPHA, E. M. Use of Cobalt 60 in Gamma-Ray Therapy 473
DOBYNS, BROWN M., ET AL. Functional and Histologic Effects of Therapeutic Doses of Radioactive Iodine on the Thyroid of Man .. 473
HENSCHKE, ULRICH K., ET AL. Radiogold Seeds for Cancer Therapy 473
EGMARK, A., ET AL. Iodine-Concentrating Thyroid Carcinomas. Three Cases 474
REID, ALLEN F., AND WILSON, BEN. Concomitant in Vivo Measurement of Regional Erythrocyte and Plasma Concentrations Using I^{131} and P^{32} 474
THOMSON, JOHN F., ET AL. Studies on the Effects of Continuous Exposure of Animals to Gamma Radiation from Cobalt 60 Plane Sources 474
MARSH, JULIAN B., ET AL. Uptake of P^{32} by Cardiac Muscle in Vivo 475
VAN CLEAVE, C. D., AND KAYLOR, C. T. Distribution and Retention of Carrier-Free Radioberyllium in the Rat 475
LITTLE, ROBERT C., AND KELLY, HERBERT B. Removal of Radioactive Gold Colloid by the Perfused Mammalian Liver 475

RADIATION EFFECTS

KIRCHHOFF, HEINZ, AND IMHOLZ, GERT. Fractures of the Femoral Neck After X-ray Therapy for Carcinoma of the Female Genital Tract 475
WERNER, K. Control of Radiation Sickness with Dihydroergotamine 475
SBERNINI, CLAUDIO, AND ORLANDINI, IVO. Effect of Roentgen Irradiation on the Laryngotracheal Lymph Vessels 476
CASARETT, GEORGE W. Comparison of Pathologic Effects of Radiation in Weanling and Adult Rats 476
MENDELSOHN, MORTIMER L., AND CACERES, EDUARDO. Effect of X-Ray to the Kidney on the Renal Function of the Dog 476

ROENTGEN DIAGNOSIS

THE HEAD AND NECK

Casts of the Cerebral Ventricles. R. J. Last and D. H. Tompsett. Brit. J. Surg. **40:** 525–543, May 1953.

Since Dandy first showed in 1918 that the ventricles when filled with air could be outlined in the roentgenogram, exact knowledge of ventricular anatomy has become necessary to both the radiologist and the neurosurgeon. For this purpose, the preparation of accurate ventricular casts assumes a practical importance, since it makes possible the measurement of the ventricles and the determination of anatomical landmarks. Most of the measurements obtained by the authors conform with those made by others on pneumograms. They describe their method of preparing casts and present their observations at length. The two main generalizations emerging from their study are that there exist wide variations in ventricular size and that the lateral ventricles display a striking asymmetry, especially of the posterior horns.

Roentgenograms of the casts are an additional aid in interpretation of ventriculograms, demonstrating clearly the grooves produced by the choroid plexus along the anterior concavity of the trigone. The x-ray shadows of the temporal horns are significant. They are most dense at the widest spread of the horn. The thinned-out biconcave tips pass medially and may not cast a shadow. If they do show in the pneumogram, the shadow may be separated from the dense shadow of the widest part of the horns and may be merely a thin curved line.

Fifteen figures, including 3 roentgenograms; 5 tables.

Upward Displacement of the Posterior Part of the Third Ventricle. A Method for Its Evaluation. Giovanni Ruggiero and Francesco Castellano. Acta radiol. **39:** 377–384, May 1953.

When there is a space-occupying lesion in the posterior fossa of the skull, the contents of the fossa tend to herniate either through the foramen magnum or through the incisura tentorii. Herniation through the foramen magnum is made visible radiologically by outlining the inferior pole of the cerebellar tonsil by pneumoencephalography. Herniation through the incisura tentorii is apparent on ventriculograms as a characteristic upward displacement of the posterior part of the third ventricle.

The variation in size and shape of the normal third ventricle and the variable shape of the skull itself make evaluation of displacement of the third ventricle difficult. The clivus, as seen on a lateral skull film, is the most regular and constant plane in the base of the skull, and the authors use this in demonstrating upward displacement of the posterior part of the third ventricle. A line tangential to the anterior inferior margin of the third ventricle is drawn on the film perpendicular to the plane of the clivus. This line may pass *through* the rostral end of the aqueduct, *above* it, or *below* it. The distance between the aqueduct and the plane of the clivus is measured.

This procedure was carried out in 10 normal cases and 10 cases of posterior fossa tumor, which were studied also with the method of Wilson and Lutz (Radiology **46:** 132, 1946). Encouraged by the comparison, the authors used their method of measurement on 50 more normal subjects, in 37 cases of tumor of the posterior fossa, and in 13 cases of non-tumoral hydrocephalus. From their observations they concluded that the posterior part of the third ventricle may be considered as displaced upward when the line passes below the rostral end of the aqueduct. In tumors of the posterior fossa, the average distance was 4.5 mm. With extraparenchymatous tumors the upward displacement averaged 2.3 mm., with intraparenchymatous tumors 6.7 mm. In cases of non-tumoral hydrocephalus the upward displacement of the third ventricle was of such extreme variation that the measurement is probably of no diagnostic value.

One roentgenogram; 5 drawings; 2 tables.

RICHARD F. MCCLURE, M.D.
Palos Verdes Estates, Calif.

Colloid Cysts of the Third Ventricle. Report of Seven Cases. James L. Poppen, Victor Reyes, and Gilbert Horrax. J. Neurosurg. **10:** 242–263, May 1953.

Seven cases of colloid cyst of the third ventricle, seen at the Lahey Clinic, are reported. This is a rare tumor, the 7 cases representing 0.55 per cent of 1,256 surgically proved brain tumors observed during a twelve-year period. Two of the patients died postoperatively.

Headache was the first symptom in 6 of the cases. Vertigo was present in 5. The symptoms are considered to be due to obstruction at the interventricular foramina. The disturbances were invariably intermittent, but the symptom-free intervals tended to become progressively shorter just before the patient sought medical aid.

The authors stress the value of ventriculography in diagnosing this condition, in which a high intracranial pressure is present without localizing signs. They believe that the ventriculograms should have been diagnostic in all their cases, but in 1 the findings were misinterpreted. In 4 cases the third ventricle did not fill with air; in 1 of these, a filling defect between the ventricles was visible in the anteroposterior view. In 2 cases, partial filling of the anterior third ventricle permitted visualization of the tumor shadow. In 1 case, some air was visible in the third ventricle in the posterior-anterior view but was not demonstrated in the other views or in the sagittal laminagram. When a filling defect cannot be demonstrated in the presence of dilated lateral ventricles, a thorough pneumographic study of the third ventricle is indicated. Several procedures for this purpose are mentioned, including laminagraphy.

A review of the air studies in the cases reported here showed broad foramina of Monro to be constant. Disparity in size between the lateral ventricles and third ventricle was also important. It is concluded that if air is visible in the posterior third ventricle and the ventricle is of normal size and the anterior third is not visualized in the presence of a broad foramen of Monro, a colloid cyst should be suspected.

It is important to make the diagnosis of colloid cyst preoperatively, since it can then be safely evacuated and the choroid plexus coagulated through a well placed trephine opening. This the authors consider the treatment of choice, giving very favorable results. Exploration by the transventricular approach entails the risk of a considerably higher mortality.

Eight roentgenograms; drawings illustrating the operative technic.

ARTHUR S. TUCKER, M.D.
Cleveland Clinic

Pneumoencephalography in Chromophobe Adenomas of the Hypophysis. Louis Bakay and James C. White. J. Neurosurg. **10**: 284–296, May 1953.

Pneumoencephalographic findings are reported for 14 cases of chromophobe adenoma with extrasellar extension: 7 from the Massachusetts General Hospital and 7 from the Serafimer Hospital, Stockholm. The authors advocate the use of pneumoencephalography to delineate the size and location of all such tumors prior to surgery or irradiation, and following treatment to observe results and evaluate possible recurrences.

The 14 cases are divided into three categories according to the extent of the lesion. The Type 1 cases were characterized by massive extension of the neoplasm directed upward and sometimes backward. In this group there is a greatly enlarged shallow sella with marked destruction, decalcification, and frequently almost complete absence of the posterior clinoid processes. Air filling of the basal cisterns reveals the protrusion of the tumor well above the normal level of the diaphragma sellae. In Type 2 cases, the sella turcica showed little enlargement or destruction, but the pneumoencephalograms revealed tumors of hourglass shape, with the suprasellar components larger than the intrasellar. The patients with Type 3 tumors had small sellas with extension of the tumor upward and usually backward, in a needle-like fashion. This group the authors consider particularly suitable for surgical removal.

The anterior part of the third ventricle is, of course, the critical area in evaluation of the roentgenograms. In some cases in which the presence of air in the third ventricle is demonstrated in the anteroposterior view but cannot be outlined on lateral films, mid-line laminagraphy may be helpful.

The authors describe their technic for filling the third ventricle and basal cisterns with small amounts of air through lumbar encephalography.

Eight roentgenograms.

ARTHUR S. TUCKER, M.D.
Cleveland Clinic

Persistent Carotid-Basilar Anastomosis. Three Arteriographically Demonstrated Cases with One Anatomical Specimen. Clinton R. Harrison and Charles Luttrell. J. Neurosurg. **10**: 205–215, May 1953.

The authors describe a large anomalous vessel which joins the cavernous portion of the internal carotid artery to the mid-portion of the basilar artery. It develops through persistence from embryonic stages of a vessel which supplies the paired longitudinal neural arteries, which in turn are the precursors of the basilar artery. Due to its close relationship to the gasserian ganglion, it has been called the persistent primitive trigeminal artery.

Seventeen such arteries were previously described in the literature, and these are tabulated. The authors add 3 cases found among a series of 526 cerebral arteriograms. The gross anatomy of a specimen obtained postmortem in one of the 3 cases is described.

The arteriographic configuration of the persistent carotid-basilar anastomosis is almost constant, and attention should be directed to the search for this vessel in any angiogram in which the posterior cerebral and basilar arteries are outlined by the carotid injection of a radiopaque medium. The close anatomical relationship of the anastomosing vessel to the sensory root of the fifth cranial nerve assumes importance in operations on or near the gasserian ganglion. During such surgery an encounter with this anomalous vessel could be hazardous.

Six cerebral arteriograms; 3 drawings; 2 photographs.

ARTHUR S. TUCKER, M.D.
Cleveland Clinic

Some Rare Diseases of the Maxillary Sinus. L. Psenner. Fortschr. a. d. Geb. d. Röntgenstrahlen **78**: 582–588, May 1953. (In German)

The writer describes the following rare diseases of the maxillary sinus and presents illustrative cases.

Mucocele and Pyocele: An antral mucocele or pyocele is an accumulation of mucous fluid or pus within the antrum leading to an increase of pressure within the sinus and to rarefaction and distention of its walls. Etiologic factors include external trauma, chronic inflammation, syphilitic changes, diseases of the bone, tumors, and scars following operation. Antral mucoceles are extremely rare. Mucocele of the frontal sinuses is much more common. The x-ray findings are easily recognized. The antrum is enlarged and cloudy, and the bony walls are thinned and definitely distended. Similar changes, however, may be caused by any slowly growing benign tumor. Clinically, the patient most often presents a soft-tissue swelling over the diseased antrum and complains of pain. Paresthesia of the involved half of the face is common. Exophthalmos and also enophthalmos were observed.

Osteoma: Primary osteomata are true tumor formations. They may develop from cartilage remnants or from the periosteum, or may represent a metaplasia of a chronically inflamed mucosa. They vary in size from small tumors, barely the size of a pea, up to large, heavy masses weighing a pound or more. They are irregularly shaped and covered by mucous membrane. The tumor itself is attached to the wall of the antrum by a stalk. Sometimes, the stalk fractures or is destroyed by a purulent inflammation. The osteoma, thus deprived of its nourishment, dies, the mucous membrane covering it disappears, and the sequestrum lies as a foreign body within the antrum. Metastases have not been observed. The clinical symptoms are scanty and not characteristic. Secondary osteomata develop through calcification of a dental cyst that has extended into the antrum. The x-ray film is quite characteristic, showing a dense, irregular bony shadow, which may more or less fill the antrum. Like mucoceles, osteomata are rare in the antrum, being more often found within the frontal sinuses.

Adamantinoma: Adamantinoma is a slowly growing tumor which develops predominantly in the lower jaw. There are solid and cystic forms, but the solid form often contains areas of vacuolar degeneration and liquefaction, so that an exact division between the two types cannot be made. The tumor may occur at any age, but is most prevalent between the thirtieth and the fiftieth year. It may contain teeth. Several theories have been advanced regarding the development of these tumors. Most authors believe that the growth of a tooth is a complex process in which structures of epithelial and of mesodermal origin are growing in a carefully balanced equilibrium. If this development is misdirected, a tumor may occur. The clinical symptoms are a painful distention in the area of the tumor. In the case described by the author, occurring in a ten-year-old child, there were sharply defined areas of radiotranslucency of variable size within the antrum.

Reactive changes on the part of the walls of the sinus were absent.

Seven roentgenograms. WM. A. MARSHALL, M.D.
Chicago, Ill.

An Inexpensive Semi-Automatic Serialographic Apparatus for Angiography. Gregory B. Nichols. J. Neurosurg. **10**: 323–326, May 1953.

The author has devised a simple apparatus for delivering cassettes and exposing them at one-second intervals for serial cerebral angiography. The device is constructed of plywood, with lead protection for the cassettes before and after exposure, and a masonite "window" through which exposures are made as each cassette falls into position. The cassettes are delivered by gravity, being released one at a time by manual operation of a "door," which is used to hold in place the cassette which is being exposed at any given time. The hand switch is by-passed for the procedure, and exposures are made automatically with each closure of the "door" by a microswitch. One technician, it is stated, may thus accomplish the exposures with confidence.

The advantages claimed for the apparatus are simplicity, low construction cost (less than $25), and adaptability. The dependence upon gravity for moving the cassettes permits the use of the equipment for lateral views only; anteroposterior views must be made by placing single cassettes under the patient's head.

Four drawings. ARTHUR S. TUCKER, M.D.
Cleveland Clinic

THE CHEST

Contribution of Angiopneumography to Some Problems of Pulmonary Physiopathology. Ricardo Rimini, Abelardo Rodriguez, Raúl Burgos, José Duomarco, José Sapriza, and Germán H. Surraco. Dis. of Chest **22**: 539–555, November 1952.

The present paper deals with 41 angiopneumographic studies made on 37 patients with different pathological lung conditions which, with some exceptions, were of tuberculous origin. A comparative study between angiopneumography and bronchospirometry was made on 24 patients and led to two important observations: (1) In the areas where absence, decrease, or delay of vascular contrast reveals diminution of circulation there exists a proportional reduction in oxygen consumption. (2) Where the oxygen consumption is diminished, there always exists a parallel reduction of circulation.

It is believed, as a result of these observations, that angiopneumography will probably replace bronchospirometry, at least in the majority of cases. In practice the first named study makes more complete the information obtained by the latter; it presents the additional advantages of making possible an appreciation of the function of the different segments of each lung.

The 41 angiopneumographic studies led to the following conclusions: "(1) In ulcero-exudative tuberculosis there exists a diminution of the respiratory function, which is moderate and proportional to the extent of the process. (2) In unilateral pneumothorax, maintained by hypotension, with a clear and elastic stump, one can notice a certain diminution of function; on the contrary, function is very much reduced or abolished in cases complicated by atelectasis of the stump or by serofibrinous or purulent pleural effusion. (3) Logically, when initial parenchymatous conditions are equal, the residual capacity of a lung, after the pneumothorax has been abandoned, is inversely proportional to the degree of the complications which might arise. (4) In pachypleuritis and in partial stenosis of a main bronchus, the respiratory function is very much reduced, much more so than could be expected through observation of ordinary plates. (5) The respiratory function disappears in fibrothorax and in cases of atelectasis. (6) Pulmonary decortication, carried out because of previous pachypleuritis, causes an improvement in the respiratory function, demonstrated by the improvement of the pulmonary circulation."

Twenty-three roentgenograms.

The Reaction of Pulmonary Tissue to Lipiodol. Warren L. Felton, II. J. Thoracic Surg. **25**: 530–542, May 1953.

Thirty-seven lung specimens from 34 patients were selected at random for investigation from a group in which intratracheal injections of iodized oil had been made three weeks to forty-seven months prior to operation. The specimens varied from a single segment to an entire lung. In all, bronchiectasis was present to some degree, and in 3 there was also a chronic lung abscess. All contained some areas of organizing pneumonitis. The amount of Lipiodol used had never exceeded 30 c.c.

A histologic survey of the materials showed no Lipiodol in 14 specimens. In 23 specimens residual Lipiodol was demonstrated histologically, and roentgenograms available in 20 of the 23 showed the presence of Lipiodol in all except 2. In 10 of the specimens the Lipiodol droplets were found free or phagocytized in alveolar spaces or the bronchial lumen without being involved in cellular reactions. Granulomas containing fat droplets were found in 6 instances. All had the form of a characteristic granuloma, with fat (Lipiodol) droplets surrounded by epithelioid cells and foreign-body giant cells encapsulated within fibrous connective tissue.

In 7 specimens Lipiodol was demonstrated in droplets concentrated in areas of non-specific organizing pneumonitis. The appearance here did not suggest a foreign-body granuloma. Radiographic correlation was possible in 6 of the cases, and in 5 the distribution of residual Lipiodol as demonstrated by x-ray examination was diffuse.

None of the Lipiodol in the lung was demonstrated in lymphatics or bronchial cartilages.

It is the author's conclusion that elimination of the oil is probably entirely by way of the tracheobronchial passages and that granulomatous reaction to retained Lipiodol in the lung is more common than is generally realized. The search for a more suitable contrast medium should continue.

Nine figures, including 2 roentgenograms.
FRANK T. MORAN, M.D.
Auburn, N. Y.

Bronchography with Joduron B. Milan Svoboda. Acta radiol. et cancerol. Bohemoslov. **6**: 118–123, December 1952. (In Czechoslovakian)

The author describes his experience with Joduron B as a contrast medium in bronchography. In 100 patients of the State Hospitals at Praha-Bulovka, Joduron B proved entirely satisfactory, especially on account of its rapid absorption. Its contrast properties and viscosity were fully adequate both in massive filling and in relief demonstration. ERNST A. SCHMIDT, M.D.
Denver, Colo.

Deformity of the Bronchi. Yuryi Holyi and Robert Poch. Acta radiol. et cancerol. Bohemoslov. **6:** 95–108, December 1952. (In Russian)

The majority of the bronchograms observed in the therapeutic clinic of Charles University of Prague showed organic and functional changes. The functional changes appeared as spasm, peristalsis, and alteration of the bronchopulmonary dynamics. Spasm caused incomplete, or rarely complete, bronchostenosis, with sharply outlined contours of the bronchial walls, varying in extent. Most often the bronchi of the first and second order were involved, especially in their proximal portions. The spasms could be identified as transitory manifestations by means of serial bronchography.

Peristalsis was seen in form of fine waves in the bronchial walls. Again, the bronchi of the second and third order were most often affected. The peristalsis was of a temporary nature, thus permitting differentiation from organic lesions due to infiltration of the bronchial walls.

By bronchopulmonary dynamics the contrast medium is slowly moved toward the alveoli. On expiration, the bronchi enlarge; on inspiration, they narrow. In pathologic conditions this dynamic process is altered: the inflamed bronchus fills more slowly than the bronchi in the neighboring healthy tissue, and the contrast medium cannot proceed into the terminal ramifications and alveoli. The bronchial lumen does not change during respiration but remains enlarged and the contrast medium stagnates in it. This phenomenon is observed in exudation, atelectasis, and pulmonary infiltration, in infiltration of the bronchial wall (inflammation, tumor), and in disturbances of the innervation or of the adjoining respiratory musculature.

As far as organic changes are concerned, the first stage of tuberculosis cannot be demonstrated by bronchography. The second stage of tuberculosis, which is largely represented by ulceration and granulomatosis with perforation of the mucosa, often presents radiologic difficulties in differentiation from endobronchial cancer. The bronchostenosis in tuberculosis is said to be generally less complete than in cancer. However, bronchial occlusions by secretion and mucus must be excluded.

Tomography may be a valuable adjunct in the diagnosis of functional and organic changes in the bronchial system.

Eight roentgenograms. ERNST A. SCHMIDT, M.D.
Denver, Colo.

Roentgenographic Aspects of Complete and Incomplete Pulmonary Infarction. Marcus J. Smith. Dis. of Chest **23:** 532–546, May 1953.

The accuracy of the roentgen diagnosis of pulmonary infarction and embolism is low as compared to the recognition of other pulmonary diseases. The author has made a study of 25 cases, seeking to correlate his findings with others reported in the literature.

Infarcts begin with edema, fluid, and red and white blood cells in the alveoli. The process may go on to necrosis of the alveolar walls, degeneration of the red cells, and subsequent organization (complete infarct), or may heal by resolution in a few days (incomplete infarct).

A complete infarct appears roentgenologically as an abnormal homogeneous density which may be triangular, round, oval, or irregular in shape. Odd and round shadows may be due to superimposed multiple infarcts. The infarct is always in contact with one or more pleural surfaces, and its long diameter is parallel to the largest pleural surface involved; its cardiac margin is rounded or hump-shaped. The size varies from 0.3 to 10 cm. in diameter, the average dimensions being 3 × 5 × 1 cm. The location is variable, with predominance in the right lower lobe. Hemorrhagic infarcts heal by organization, leaving one or more scars, which appear as irregular linear bands and require differentiation from areas of plate-like atelectasis and interlobar pleuritis, or complete resolution may occur.

Secondary signs associated with complete infarcts—often misleading—are: (1) loss of aeration in the region of the costophrenic sinuses (explanation unknown); (2) accentuation of hilar vessels on the side of the lesion; (3) elevation of the diaphragm on the affected side; (4) pleural effusion.

Incomplete infarcts usually disappear within twenty-four to forty-eight hours. In the 3 cases of this type in the author's series they were manifest on the roentgenogram by faint, sharp, short lines situated transversely or obliquely, coincident with the clinical occurrence of pulmonary emboli.

The author has tabulated the findings in his 25 cases, indicating the etiology, location, shape, size, and secondary signs. He also discusses the x-ray findings described by Westermark (Acta radiol. **19:** 357, 1938. Abst. in Radiology **32:** 634, 1939) for embolism without infarction: a sharply localized wedge-shaped area of increased radiability on the peripheral side of the lung embolus.

Fourteen roentgenograms; 1 table.

HENRY K. TAYLOR, M.D.
New York, N. Y.

The Early Recognition and Treatment of Bronchogenic Carcinoma. Jack Reiss, George L. Baum, and Maurice Kovnat. Dis. of Chest **22:** 529–538, November 1952.

A clue to the existence of early bronchogenic carcinoma is often to be obtained by simple radiographic technic, but delayed diagnosis is all too frequent. Of 70 consecutive patients seen by the authors, only 20 were deemed to be operable. It is proposed that roentgenograms of the chest be taken on all adult members of the population at six-month intervals. This can be done on all healthy individuals, on all hospital admissions, and as part of every pre-employment examination in each industry. Routine chest x-ray films should be obtained for all persons seen in the physicians' offices. Since lesions have been overlooked in survey examinations, it is felt that each survey film should be inspected by two competent physicians, one of whom should be a qualified radiologist. Any differences of opinion could then be mediated by appropriate consultation and studies.

Eleven roentgenograms; 1 table.

Bronchogenic Carcinoma Simulating Benign Pulmonary Disease. G. V. Brindley, Jr. Ann. Surg. **137:** 616–624, May 1953.

The author again emphasizes the markedly increased incidence of bronchogenic carcinoma. Confusion in the recognition of this disease may be due to coexistence of a benign pulmonary disease or simulation of a benign lesion by the neoplasm.

Coexistent carcinoma and tuberculosis are seen with increasing frequency. In a known case of tuberculosis,

progressive cough without increase in sputum may suggest carcinoma. Also, progressive weight loss and anemia in spite of adequate therapy should arouse suspicion. Roentgenograms are often not diagnostic.

Other conditions which may be confused with or mask carcinoma are fungous disease, bronchiectasis, lung abscess, benign pulmonary neoplasm, and mediastinal tumor. The author presents several illustrative case histories with roentgenograms and operative and pathological findings.

Eleven roentgenograms; 7 photographs.

LAWRENCE A. DAVIS, M.D.
University of Louisville

The Association of Tuberculosis and Primary Bronchogenic Cancers. J. Delarue, R. Depierre, J. Paillas, and J. Pointillart. J. franç. méd. et chir. thorac. **7:** 449–476, 1953. (In French)

Among 600 patients with bronchogenic carcinoma 14—all males—had coexistent tuberculosis. In 7 cases the carcinoma dominated the clinical picture. Roentgenographic diagnosis may be difficult when the tuberculous disease appears on the same side as the tumor. The presence of a cavity apart from the apparent primary tumor, or the appearance of changes that could be inflammatory in a separate lobe of the same side or on the opposite side, should lead to repeated search for tubercle bacilli.

In 4 of the authors' patients the tuberculous lesions were of long standing. In such cases, persistent signs of a mass lesion or bronchial obstruction call for bronchoscopy and further studies to detect the tumor.

In 3 cases the presence of tuberculosis was detected after radiotherapy for cancer. This is usually seen in the form of an acute tuberculous pneumonia. Cases have been reported in which the tuberculous process followed surgery. Radiologically, there is usually rapid development of a dense, homogeneous opacity on the same side as the tumor, which may have regressed following therapy.

In the authors' series, 11 of the tumors were of squamous-cell type, 2 were small-cell carcinomas, and 1 was an undifferentiated adenocarcinoma.

Six roentgenograms; 3 photographs; 1 photomicrograph.

CHARLES M. NICE, M.D.
University of Minnesota

Thoracic Sympathicoblastoma Simulating an Intrapulmonary Tumor. Zdeněk V. Skokan. Acta radiol. et cancerol. Bohemoslov. **7:** 108–113, April 1953. (In Czechoslovakian)

Roentgenographic examination of a sixty-eight-year-old patient with a long history of cough showed a hemispherical shadow in the upper mediastinum. Bronchoscopy and bronchography revealed compression of the right main bronchus, suggesting a diagnosis of intrapulmonary tumor. At operation the location was shown to be extrapulmonary and histologically the growth proved to be a sympathicoblastoma.

Two roentgenograms; 1 photograph.

An Unusual Case of Intrathoracic Fibroma Associated with Pulmonary Hypertrophic Osteoarthropathy. Otto Deutschberger, Anthony A. Maglione, and John J. Gill. Am. J. Roentgenol. **69:** 738–744, May 1953.

Intrathoracic fibromas are encapsulated, non-invasive tumors of unusual occurrence. They may originate from the mediastinum, lungs, pleura, or any tissues of the thoracic wall or vertebrae and may attain a large size before symptoms are produced as a result of pressure. The authors' case differed from others recorded in the literature in the presence of hypertrophic osteoarthropathy.

This latter condition is most commonly associated with bronchogenic carcinoma. The changes are those of chronic proliferative subperiosteal osteitis. The distal portions of the radii, ulnae, tibiae, fibulae, metacarpals, and metatarsals are most frequently affected. The symptoms simulate those of arthritis. Clubbing of the fingers and toes is one of the commonest signs. Roentgenologic examination reveals irregular periosteal accretions of new bone along the shafts of the long bones and along the periphery of the larger pelvic and shoulder girdle bones. This periosteal response is usually much less dense than the cortex and as a rule is irregular and "woolly" in appearance. There is usually some degree of associated osteoporosis of all bones.

The authors' patient was a 60-year-old man who was first found to have a left-sided intrathoracic mass twenty-two years prior to his admission to the hospital. He had episodes of non-productive cough, and during one of these a second roentgenogram was taken, sixteen years after the first. This showed the mass to have increased considerably in size. A year later (five years prior to admission), painful swelling of his ankles and wrists occurred, with broadening of the fingernails. These symptoms increased in severity, and dyspnea and hoarseness gradually developed. Following admission, a roentgenographic study revealed a large mass in the left hemithorax, displacing the heart and the mediastinum to the right. The left lung was only slightly aerated in the apex and anterior aspect of the upper portion. Laminagrams showed, in addition to the tumor, slight erosion of the bodies of the upper thoracic vertebrae on the left side. No Lipiodol entered the left bronchial tree at bronchography. Bone studies revealed widespread pulmonary hypertrophic osteoarthropathy.

A thoracotomy was performed, and a large, well encapsulated mass, which seemed to derive its blood supply from the posterior pleura, was found. A left pneumonectomy was done. The tumor proved to be a fibroma. The patient had an uneventful postoperative course; four months following operation his symptoms had subsided.

Eight roentgenograms; 3 photographs; 1 photomicrograph.

SEYMOUR A. KAUFMAN, M.D.
Boston, Mass.

The Solitary Pulmonary Focus—Carcinomatous or Otherwise, with Particular Reference to Histoplasmosis. W. A. Jones. J. Canadian A. Radiologists **4:** 15–19, March 1953.

This presentation adds another condition to be considered in the differential diagnosis of solitary pulmonary foci. Three cases are presented (with a note that 3 more have since been found) in which solitary nodules proved to be due to histoplasmosis.

The main characteristic noted by the author is a "tell-tale calcified nucleus surrounded by a halo." He concludes: "In these days, when medical opinion is becoming perhaps over-conscious of pulmonary carcinoma; when the so-called 'coin lesion' has by its very name become suspect of cancer; when it is so easy to suspect a cancer of having evolved from or around an

old calcified lesion of some type; it is perhaps wise to think of a simple thing, and to do a histoplasmin skin test before going on to greater things."

Six roentgenograms. JOSEPH P. TOMSULA, M.D.
Baton Rouge, La.

Concerning a Case of Pulmonary Lymphangiectasis. K. Reinhardt. Radiol clin. **22:** 162–167, May 1953. (In French)

A 30-year-old woman was first seen in May 1950 with a history of having been ill for two years. At the age of twenty-eight she began to have repeated episodes of "collapse." She had produced sputum that was thick, milky, and yellowish-red in color. Diffuse nodulo-reticular opacities were roentgenologically demonstrable in both lung fields. Venous stasis of the left arm was present. Thoracentesis revealed chylothorax. Dyspnea, cyanosis, and emaciation were progressive, but there was no fever. Death ensued in 1951.

This case seems to be similar to one described by Delarue, Depierre, and Roujeau (Semaine hôp. Paris **26:** 4906, 1950), in which widespread lymphangiectasis of the lungs and chylous pneumonia were present on postmortem examination. Those authors suggested that the changes might have been caused by obstruction of the thoracic duct due to thrombosis of the subclavian vein.

One roentgenogram; 1 drawing.

CHARLES NICE, M.D.
University of Minnesota

A Case of Lung Cyst in Infancy. Doreen Murphy. Irish J. M. Sc., pp. 220–222, May 1953.

Differentiation between acquired and congenital lung cyst is difficult and sometimes impossible. A congenital cyst is the result of aplasia of alveoli. At the sixth month of intra-uterine life the respiratory antrum does not evaginate and the already formed bronchus dilates to take the place of alveoli. Acquired cysts in infancy result from pneumonia, almost always staphylococcal in origin. Peribronchial consolidation results in suppuration in the form of multiple tiny abscess cavities. If the abscess bursts into and empties itself through a bronchus, a small cavity remains and a tension cyst develops. The cyst may rupture into the pleural cavity and produce a tension pneumothorax.

A detailed case report of an acquired cyst is given, with roentgenograms obtained at intervals, showing the original bronchopneumonia, subsequent pneumothorax and the cyst on the surface of the lung, re-expansion of the lung with the cyst still present, and finally the fully expanded lung with no evidence of cyst. The infant was three weeks old at the time of the pneumonia and approximately six months old at the time that the final film was taken.

Four roentgenograms. D. deF. BAUER, M.D.
Coos Bay, Ore.

An Evaluation of Extrapleural Pneumonolysis Based on a Follow-up Study of Seventy Cases with Lucite Plombage. Jacob Zimmerman, John B. Grow, and Allan Hurst. Dis. of Chest **22:** 491–513, November 1952.

In 1946, extrapleural pneumonolysis with lucite ball plombage began to be used as a permanent collapse procedure at the National Jewish Hospital (Denver, Colo.) in cases otherwise suitable for thoracoplasty. As results in the early cases were encouraging, the indications were widened and many cases were treated in this way which were unsuitable for thoracoplasty or other procedures. Complete information as to the late results (roentgen studies and sputum reports) was available in 67 of 70 patients. The interval since treatment ranged from over five years to two years and three months, averaging just over three years.

The tuberculous process was controlled in a high percentage of cases. In 72 per cent of 54 patients in whom unilateral plombage was performed, the sputum became negative; 5 of 9 cases with bilateral plombage also became negative. In the remaining 7 cases it was planned to combine resection and plombage. The two procedures were actually carried out, however, in only 4 patients, with inactivation of the disease in 3.

The chief complication of extrapleural pneumonolysis is the formation of a broncho-extrapleural fistula. In stripping the parietal pleura away from the chest wall, the most diseased part of the lung is deprived of its natural emergency mechanism and left to the mercy of the pathological process. This may lead to perforation of a cavity, with fistula formation. This complication may occur as an accident during operation or a few months later, when the peripheral aspect of the lung, largely devitalized at the time of surgery, has become necrotic. In 3 of the authors' cases such fistulae occurred within six months after operation. In all 3 cases there was large giant cavitation without any normal parenchyma between the cavity and the pleura. All 3 patients died. A careful preoperative x-ray study, including tomography, will indicate the condition of the peripheral aspect of the lung in the majority of patients and permit the exclusion of cases with giant or peripheral cavitation.

The possibility of fistula formation at a later date remains, however, even in cases considered suitable for extrapleural pneumonolysis. To avoid this, the procedure should be planned ideally in every case as a temporary collapse procedure, and thoracoplasty, sufficient to collapse the space, should be performed as soon as the extrapleural shelf has become satisfactorily stabilized.

Extrapleural plombage increases the danger of bronchopleural fistula after resection. This complication developed in 4 out of 12 of the authors' cases in which lucite spheres were inserted either preoperatively or as a prosthesis at the time of resection.

Six roentgenograms; 7 tables.

Anthracosilicosis Occurring in a Foundry Employee. L. E. Hamlin. Arch. Indust. Hyg. & Occup. Med. **7:** 339–351, April 1953.

The case is reported of a foundry molder who demonstrated the clinical, roentgenologic, and pathological pulmonary changes seen in the pneumoconiosis of coal workers. It is suggested that the two conditions may be identical, since exposure to sea coal in foundry-molding practices offers a potential source of exposure.

The patient started working in the foundry at about twenty years of age. In 1933, when he was twenty-nine, a chest roentgenogram revealed no irregularity except suggestive evidence of mild cardiac enlargement. The blood pressure was 180/90. In May 1944, the patient was feeling well and a chest film disclosed no change in the earlier roentgen pattern except that there was now no evidence of cardiac enlargement. The blood pressure was 140/80. Four years later, in November 1948, a roentgenogram showed definite

nodular shadows suggestive of early silicosis throughout both lung fields. A change of work was considered, but because of lack of symptoms, the mild degree of lung nodulation, and the apparently safe atmospheric dust concentrations in the plant, there did not appear to be sufficient danger to health to warrant an immediate modification of the patient's activities. In January 1949, operations at the plant were discontinued and he preferred to accept a service award rather than to take other employment. A roentgenogram, taken in July 1949 revealed no further progression of the lesion.

In August 1949, the patient's condition was discussed fully with him, and he stated that about three years previously he had pleurisy. Since he had stopped working, however, he "felt better than he ever did." A roentgenogram in December 1949 showed no new developments. About a month later he was referred to a cardiologist because of the very rapid development of symptoms indicating definite congestive heart failure. Fluoroscopic examination revealed enlargement of the right ventricle of the heart, and the electrocardiogram was typical of chronic cor pulmonale, with right ventricular strain pattern. The venous pressure was increased to more than twice the normal, and the circulation time was more than double the accepted standard. Death occurred in May 1950. Diagnosis at autopsy included the following: pneumoconiosis; pulmonary emphysema; coronary sclerosis, advanced; left coronary occlusion; cardiac hypertrophy; cardiac fibrosis; passive congestion of liver and spleen.

The development of signs and symptoms which terminated fatally within nine months emphasizes the need for early recognition of this condition in foundry workers. Accurate interpretation of clinical and roentgen findings is stressed, particularly as far as these are related to cardiovascular disease.

This case directs attention to the value of competent pathological studies, when possible, in the proper evaluation of such industrial health problems.

Four roentgenograms; 6 photomicrographs.

Tracheopathia Osteoplastica. Report of a Case. William A. Lell. Dis. of Chest **23**: 568–571, May 1953.

In tracheopathia osteoplastica there are small spicule-like nodulations of bony tissue beneath the mucous membrane and between the cartilaginous rings of the trachea and main bronchi. These spicules may progress to produce narrowing of the tracheal and bronchial lumen of varying degree, with clinical and x-ray manifestations simulating other types of pulmonary disease. The diagnosis can seldom be made antemortem without endoscopic aid.

The author gives the case history of a 68-year-old white male in whom the clinical picture was that of bronchiectasis, the roentgenographic findings were suggestive of cancer, and the bronchoscopic examination revealed tracheopathia osteoplastica.

Two roentgenograms. HENRY K. TAYLOR, M.D.
New York, N. Y.

Osteochondroma of the Bronchus. Rudolph Nissen, James R. Lisa, and Wolf Elkan. Am. J. Surg. **85**: 694–697, May 1953.

Cartilaginous tumors arising from the larger bronchi are relatively rare, only 23 cases having been reported in the medical literature. A case report is given of a 53-year-old male who was found to have an osteochondroma of a bronchus. The patient was a heavy smoker with a history of mucopurulent sputum, occasionally blood-streaked, and weight loss. Roentgenograms revealed asymmetry of the chest, the left side being smaller. There was an area of density at the left base, apparently due to fibrous thickening; the lower lobe was atelectatic, and strands of density were demonstrable in the lower lung field. The left dome of the diaphragm was elevated, with a mediastinal shift to the same side. A left pneumonectomy was performed and a hard cartilaginous mass obstructing the lumen was found at the mouth of the medial basal segmental bronchus. Bronchiectasis of all the segmental branches of the lower lobe was also present. Microscopically, the tumor was seen to arise from a cartilage of the bronchus and lay in the mucosa. It consisted mainly of fibroelastic cartilage with numerous areas of true bone formation.

The clinical course in this type of tumor is usually one of recurrent unilateral pulmonary infection over a long period. Although, as far as is known, none has ever proved malignant, removal is the procedure of choice.

Two roentgenograms; 1 photograph; 3 photomicrographs. SEYMOUR A. KAUFMAN, M.D.
Boston, Mass.

Cinefluorographic Studies of Cardiovascular Disease. Robert F. Rushmer, Dean K. Crystal, Robert A. Tidwell, and John A. Hendron. Am. J. Roentgenol. **69**: 385–394, March 1953.

Cinefluorography is particularly suited to the study of repetitive activity with a short cycle length, or of phenomena which occur too rapidly for adequate observation during roentgenoscopy. The authors describe a method of continuous cinefluorographic angiocardiography and illustrate its application in an infant with coarctation of the aorta and in other conditions.

The apparatus consists of a Patterson B_2 fluorescent screen mounted in a 14 × 17-inch cassette from which the metal back has been removed. Two front-silvered mirrors reflect light from the screen to a 16-mm. Bolex motion picture camera 5 feet away mounted in a lead-lined compartment. The component parts are installed in a light-tight box for use under ordinary room light.

With a camera film speed of 15 frames per second, an *f*1.4 lens, and 96 kv. and 175 ma., at a tube-screen distance of 40 inches, sufficient penetration is obtained for a postero-anterior view of an adult chest 21 cm. thick. Substituting an *f*0.8 lens makes the apparatus suitable for angiocardiography. A maximum exposure of 20 r on the skin is allowed per examination. Examinations are not repeated in less than six months.

Cinefluorograms provide a permanent record of fluoroscopic findings, yet allow greater contrast and illumination than can be obtained during routine fluoroscopy. The apparatus can be used with standard radiographic equipment of sufficient capacity. Aside from the greater volume of tissue exposed, the required exposure compares favorably with routine fluoroscopy.

Cinefluorograms are reproduced.

DONALD A. OTTO, M.D.
Detroit, Mich.

Fluorodensography With Radiopaque Substance. A New Method for Hemodynamic Investigation. Gustavo Moros G., Rafael José Neri, and Guillermo Villagordoa. Am. Heart J. **45**: 495–499, April 1953.

Fluorodensography is the term applied by the authors to an electrokymographic examination during the in-

travenous injection of 4 c.c. of 70 per cent Diodrast. Since the ascending and descending branches of the ventricular curve represent density changes, the idea was conceived that the injection of a radiopaque substance would cause changes in density on its arrival in the cardiac cavities that could be better registered on the electrokymogram with the help of adequate photoelectric cells. This assumption was found to be correct, as is shown by a curve reproduced in the paper. The arrival of the medium at the left ventricle sensibly altered the curve, whose depth increased as the concentration in the ventricle increased. Analysis of the curve in relation to the cardiac sounds showed that inflections due to positional changes occur during isometric contraction and relaxation and were not modified in this particular instance, but the changes due to density, which occur during ventricular filling and ejection, were very obviously altered.

The authors believe that the method will be valuable for the measurement of circulation times, especially pulmonary circulation time, and in the study of arteriovenous shunts, functional capacity of the heart, residual intracavity volumes, and other cardiovascular problems.

Two fluorodensographic curves.

HENRY K. TAYLOR, M.D.
New York, N. Y.

Report of Committee (of American Heart Association) on Cardiac Catheterization and Angiocardiography. Andre Cournand, Chairman. Ann. Int. Med. **38**: 1081–1087, May 1953. Also in Circulation **7**: 769–773, May 1953.

This evaluation of cardiac catheterization and angiocardiography, undertaken under the auspices of the American Heart Association, is based upon approximately 5,700 right heart catheterizations carried out in eight institutions (with 4 fatalities) and 1,325 angiocardiographic studies in two laboratories. It led to the following conclusions:

"1. Cardiac catheterization and angiocardiography can supply, if properly applied, a considerable amount of diagnostic and physiologic information in human subjects which is otherwise not available.

"2. There is a definite risk of injury or death to the subject, which is influenced by the presence, type, and severity of heart disease. This risk can be minimized by adequate precautionary measures which can probably best be effected in large centers, utilizing specially trained medical and technical personnel.

"3. It is worthy of emphasis that these methods can serve physicians best as a supplement to, rather than a substitute for, clinical and radiologic examination."

Mitral Stenosis. Diagnosis and Treatment. Andrew Logan and Richard Turner. Lancet **1**: 1007–1018; 1057–1064, May 23 and 30, 1953.

In a long paper on mitral stenosis, based for the most part on 100 cases from 200 in which thoracotomy was done for mitral valvular disease, the authors devote some space to the radiologic aspects. Only that part of their contribution will be abstracted.

A rough impression of the severity of the underlying cardiac disease can be obtained from an estimate of the degree of cardiac enlargement. It is not, however, sufficient to say that the heart is enlarged; one must decide which chambers are enlarged to what degree. The condition of the aorta, of the pulmonary artery and its main branches, and of the lung fields should also be noted.

When severe mitral stenosis develops early in life, the aorta is much smaller than normal. When there is also aortic incompetence, the aorta may be enlarged and may show excessive pulsation. In the series upon which this study was based, marked enlargement of the artery was usually associated with severe stenosis and high pulmonary arterial pressure. In only 3 cases was the pulmonary artery enlarged to the extent seen in other conditions such as interatrial septal defect.

Visibility of the left auricle, forming the prominence on the left cardiac border next below the pulmonary artery in the postero-anterior view, suggests that an easy approach to the mitral valve will be available. The shadow of the left atrium can nearly always be seen behind the right atrium in the anterior view and in this position its size may sometimes be better appreciated than in the right anterior oblique projection. This has not in general, however, been found to be a reliable guide as to whether mitral stenosis or incompetence is the predominant defect.

The size of the right atrium is best noted in the postero-anterior view, and that of the right ventricle in the left anterior oblique view. In the presence of right-sided enlargement there is probably considerable pulmonary arteriolar resistance, tricuspid disease, or severe myocardial damage. When the right ventricle is enlarged, as is often the case, it may be difficult to differentiate enlargement of the left ventricle (as in mitral incompetence) from displacement to the left in the postero-anterior view or backward in the left anterior oblique view. In these circumstances, radiology is of less value than clinical or electrocardiographic assessment.

Calcification may be detected in the cusps or in the ring of the valve. Advantage may be taken of this to compare the movement of the mitral valve with that of the barium-filled esophagus outlining the posterior border of the left atrium in the right anterior oblique view. Movement in the same direction in patients with pure mitral stenosis has strengthened the authors' conviction that upward movement of the anterior cusp of the mitral valve into the atrium contributes to systolic expansion of the atrium, which is not therefore necessarily a sign of mitral incompetence, as has been claimed.

Radiologic signs of pulmonary congestion, *i.e.*, increased vascular markings, are uncommon in patients with mitral stenosis and are of little help as a guide to pulmonary hypertension or cardiac failure. The characteristic shadows of pulmonary edema, usually densest in the circumhilar region, are indicative, except in pregnancy, of severe mitral stenosis.

One roentgenogram.

Roentgenologic Diagnosis of Traumatic Rupture of the Thoracic Aorta. Alvin C. Wyman. Arch. Surg. **66**: 656–663, May 1953.

Traumatic rupture of the aorta as the result of a non-penetrating thoracic injury is rarely recognized antemortem. Three cases are reported with survival periods of eleven hours to eight days, permitting sufficient time for clinical and roentgenographic consideration. Bed-side films of the chest in these 3 cases showed widening of the superior mediastinum with distortion, irregularity, and haziness of the aortic arch.

In addition, a "layering" effect was noted about the arch, as if due to different stages of coagulation and repeated hemorrhage. Such findings, while not pathognomonic, are suggestive of aortic rupture in conjunction with thoracic injury. At autopsy, mediastinal hematomas were demonstrated in the region of the aortic arch.

A fourth patient, presenting similar roentgenographic findings following severe thoracic trauma, recovered without surgical intervention and was presumed to have had mediastinal hemorrhage from some vessel other than the aorta.

Twelve roentgenograms. JAMES M. SWAIN, M.D.
Cleveland Clinic

Idiopathic Dilatation of the Pulmonary Artery. R. H. Goetz and Maurice Nellen. South African M. J. **27:** 360–367, May 2, 1953.

In diagnosing idiopathic dilatation of the pulmonary artery other causes of enlargement of the pulmonary artery (left-to-right shunts, poststenotic dilatation, etc.) must be excluded, principally by cardiac catheterization and angiocardiography. If no shunts are found by blood oxygen studies and there is no hypertension in the pulmonary system, an enlarged pulmonary artery must be interpreted as due to idiopathic dilatation.

It is important to differentiate the condition from pure pulmonic stenosis. In both conditions there may be systolic murmurs and thrills and the roentgenogram may show similar enlargement of the pulmonary artery. The most significant finding in idiopathic dilatation is the normal pressure in the right ventricle and in the pulmonary artery. In pulmonic stenosis the pressure in the ventricle is higher than normal and low in the artery. With a patent ductus the pressure relationship would be just reversed and in pulmonary hypertension the pressure would be elevated in both the ventricle and artery.

Four cases are reported which fit the diagnostic criteria for idiopathic dilatation. No anatomical confirmation was obtained since surgery is not indicated and all the patients were clinically well.

Ten roentgenograms; 2 electrocardiograms; 2 phonocardiograms; 2 tables.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

THE DIAPHRAGM

Herniation of the Right Diaphragm Secondary to Trauma. Ernest C. Strode and Charles A. Vance. Ann. Surg. **137:** 609–613, May 1953.

Roentgenograms of the thorax should be the starting point in investigation of traumatic diaphragmatic hernia. Following trauma, any suspicious shadow within the bases of the pleural cavity must be examined with the possibility of diaphragmatic hernia in mind. Lateral views of the thorax may aid in clarifying the suspicion, but a definite diagnosis depends on the examination of the alimentary canal by the use of opaque media. The treatment is surgical and consists of repair of the diaphragmatic defect. When the hernia is obstructed or strangulated, immediate operation is imperative.

Ninety-five per cent of all traumatic diaphragmatic hernias occur on the left side. A case is reported here in which the hernia was on the left, with several loops of small bowel, the transverse colon, about half of the stomach, the right lobe of the liver, and the gallbladder in the right chest.

Six roentgenograms; 1 drawing.

CLAUDE D. BAKER, M.D.
Louisville (Ky.) General Hospital

Partial Eventration of the Right Diaphragm. Morton M. Axler and Robert L. Rehermann. J. Pediat. **42:** 320–324, March 1953.

A case is presented of partial eventration of the right leaf of the diaphragm in a child seen at the age of five years. At the age of nine weeks the patient had recurrent vomiting, which was thought to be due to pylorospasm. At that time a mass of unknown nature was noted in the right chest. Fluoroscopically this appeared to be independent of the diaphragm. The child appeared to progress normally thereafter but experienced recurrent episodes of respiratory infection and fever of unknown origin. Cyanosis on crying was noted.

Roentgen examination revealed a smooth ovoid mass of homogeneous density, approximately 4.5 cm. in diameter, in the right cardiophrenic sulcus. It was inseparable from the right margin of the cardiac silhouette. The subjacent portion of the diaphragm was intact and moved with normal amplitude. The mass did not pulsate.

An exploratory thoracotomy revealed a bulge of the diaphragm close to the pericardial edge. An incision through the diaphragm revealed normal liver tissue beneath it.

The authors believe that surgical exploration presents less risk than diagnostic pneumothorax and pneumoperitoneum as an approach to the diagnosis of eventration. At the exploratory thoracotomy, surgical repair can be attempted if it is indicated.

Three roentgenograms.

HOWARD L. STEINBACH, M.D.
University of California

Roentgenologic Symptomatology of Diaphragmatic Tumors. Slavoj Věšín. Acta radiol. et cancerol. Bohemoslov. **6:** 109–117, December 1952. (In Czechoslovakian)

The number of diaphragmatic tumors described in the medical literature is relatively small. The author places the number at 30 (up to 1949), of which only 5 were diagnosed by means of x-rays. He adds 4 cases of his own, 3 of which were verified by operation or at autopsy. A correct diagnosis was made in all the verified cases.

In the typical case of diaphragmatic tumor, a round hemispheric shadow in contact with the diaphragm is visualized. Occasionally the tumor may present a wedge-shaped or triangular appearance. The connection with the diaphragm may be established by the use of diagnostic pneumoperitoneum or pneumothorax. Pneumothorax, however, may fail to furnish the required differential diagnostic factors when a large tumor adheres to the base of the lung, which consequently does not collapse, or when the tumor is so firmly attached to the diaphragm that the air cannot penetrate above it. As a rule, the x-ray appearance does not allow a distinction between benign and malignant tumors. Therefore operative treatment should always be carried out unless contraindicated clinically.

The diaphragmatic tumors observed and presented by the author are: (1) a reticular fibrosarcoma in a 35-year

old man; (2) a neurofibroma in a 47-year old woman; (3) a subpleural lipoma in a 63-year old man. The fourth case, which was diagnosed radiologically but not confirmed, was probably a benign tumor. Another case came to the author's attention after completion of this series, an extrapulmonary fibrosarcoma in a 59-year old patient. The observations published covered the years from 1943 to 1951.

Eleven roentgenograms: 1 photograph.

ERNST A. SCHMIDT, M.D.
Denver, Colo.

THE DIGESTIVE SYSTEM

Non-Malignant Roentgen Changes in the Gastro-Intestinal Tract Associated with Aging. Everett L. Pirkey, Lawrence A. Pilla, and Doris E. Pipkin. South. M. J. **46**: 446–449, May 1953.

The importance of non-malignant changes in the gastrointestinal tract in the aged is emphasized. Four illustrative cases are presented: 1 of tertiary esophageal contractions, probably resulting from senile degeneration of the intrinsic nervous mechanism of the musculature; 1 of partial esophageal obstruction secondary to severe aortitis, aortic dilatation, and periaortic scar tissue; 1 of volvulus of the colon, and the fourth of diverticulitis.

Early recognition of the correct diagnosis and the institution of proper treatment in these non-malignant conditions will frequently be life-saving.

Five roentgenograms.

Partial Spontaneous Rupture of the Oesophagus. E. M. Nanson and R. Milnes Walker. Brit. J. Surg. **40**: 574–577, May 1953.

The authors present a case of partial spontaneous rupture of the esophagus, successfully diagnosed and treated. The value of early roentgenologic examination is stressed. A barium swallow twenty-four hours after the onset of symptoms indicated the diagnosis in this case. The authors believe there is little danger in roentgenologic screening if the surgeon is prepared to act promptly.

It is interesting that the trauma in this case was slight, merely the swallowing of a sweet roll. Also the site of rupture, in the middle third, was unusual. Operative intervention was delayed six days. Repeated barium swallow examinations and esophagoscopies failed to establish the definite diagnosis sooner. Presumably antibiotic therapy maintained the patient in good condition throughout this period of delay.

A concise review of the 22 cases of spontaneous esophageal rupture successfully treated since 1947 is presented. They fall into two groups: 13 were correctly evaluated preoperatively and deliberate thoracotomy was performed to repair the defect; 9 cases presented as empyemas, with a correct diagnosis only after drainage. Prior to 1947 no instance of successful treatment had been recorded.

Four roentgenograms. R. F. LEWIS, M.D.
Cleveland Clinic

Esophageal Obstruction Due to Serutan. A. Melamed and A. Marck. J.A.M.A. **152**: 318–319, May 23, 1953.

The authors report the case of a patient whose food intake had been somewhat limited since subtotal gastrectomy four years previously because of recurrent gastrointestinal bleeding. His lower esophagus was completely obstructed as a result of ingestion of two teaspoonfuls of dry Serutan (taken without first reading the directions) followed by a "swallow of water."

Treatment included morphine and atropine, intravenous glucose, and oral mineral oil. Following two doses of the latter, emesis of an ovoid rubbery foreign body, 17 × 19 mm., occurred, and the patient was completely relieved of symptoms.

The authors suggest that patients who have had gastric resections might well be advised to be cautious in, or perhaps to refrain from, ingesting hygroscopic substances.

[This and other reports in the literature of obstruction of the esophagus from the hygroscopic bulk laxatives prompted a letter to the editor (J.A.M.A. **153**: 235, Sept. 19, 1953) from Wingate M. Johnson, M.D., Winston-Salem, N. C., in which dramatic relief of a similar obstruction due to Serutan was obtained almost immediately following the administration of 8 c.c. of liquid Taka-diastase. The writer recommends further trials of this starch digestant in cases where obstruction is due to carbohydrate material.]

One roentgenogram; 1 photograph.

ARTHUR S. TUCKER, M.D.
Cleveland Clinic

Diagnosis of Cardiospasm. Arthur M. Olsen, Colin B. Holman, and Howard A. Andersen. Dis. of Chest **23**: 477–497, May 1953.

Cardiospasm, also referred to as achalasia, preventriculosis, phrenospasm, mega-esophagus, and esophagectasia, is a non-organic stenosis of the lower end of the esophagus. Usually the narrowing does not extend for more than 4 to 6 cm. above the junction of the esophagus with the stomach. The condition is essentially a disturbance in the physiologic sphincter at the cardia. It is not to be confused with diffuse spasm of the esophagus or intermittent spasm at the cardia. The authors' observations are based on a study of 601 cases. Cardiospasm occurs at all ages, but is seen most frequently in middle life. The symptoms are obstruction to swallowing, which occurs in practically all cases, regurgitation (60 per cent), pain (29 per cent), and hemorrhage (2.5 per cent). At times patients complain of hiccups or excess salivation. Dyspnea, coughing, and wheezing, when present, indicate pulmonary complications.

The most important diagnostic procedure is the roentgenographic examination. This will demonstrate the outline of the constricted segment at the cardia, degree of obstruction, extent of enlargement or dilatation above the constriction, length and course of the esophagus, alterations in its muscular activity, and evidence of retained food or fluid.

Cardiospasm is a progressive disease. The authors recognize four stages, depending upon the degree of esophageal dilatation. Stages 1 and 2 represent a compensated phase, with thickening of the musculature and increased though ineffectual muscular activity. Stages 3 and 4 represent decompensation. Motility is reduced or absent, there is progressive dilatation of the esophagus, and subsequently elongation and angulation occur.

Lesions which may simulate cardiospasm include neoplastic stenotic lesions of the cardia, intraluminal benign tumor of the esophagus, stenotic lesions at the

cardia due to ulceration, stricture or foreign body, diffuse spasm of the esophagus, and scleroderma.

Esophagoscopy is usually unnecessary to make the diagnosis, but is sometimes desirable to exclude carcinoma.

Associated conditions found in the authors' series were: duodenal ulcer in 25; gallbladder disease in 23; diaphragmatic hernia in 10; gastric carcinoma in 2; gastric ulcer in 1; carcinoma of the colon in 2; heart disease in 10; goiter in 5; urinary calculi in 3; carcinosis in 1. Of more than passing interest were the simultaneous occurrence of diffuse spasm with cardiospasm in 40 cases, coexistence of cardiospasm and megacolon in 1 instance, esophageal diverticula in 7, and bulbar palsy in 2 patients. It is conceivable that diverticula interfere with the orderly propagation of peristaltic waves and that cardiospasm in these cases may be the result of mechanical interference with the normal mechanism of swallowing.

Though degenerative changes have been commonly demonstrated in Auerbach's plexus, the etiology of cardiospasm remains obscure. In the authors' opinion, it probably is not primarily a psychosomatic disease.

Fourteen roentgenograms; 1 graph; 1 table.

HENRY K. TAYLOR, M.D.
New York N. Y.

Roentgen Examination of the Stomach with Tetraethylammoniumbromide (TEAB). A New Pharmacodynamic Procedure. M. Fóti. Fortschr. a. d. Geb. d. Röntgenstrahlen **78:** 566–573, May 1953. (In German)

The author opens the old question as to the value of pharmacodynamic x-ray examination of the stomach. He refers to the studies of Gutmann, which were based upon the fact that certain pharmaceuticals have a hyperkinetic action upon the stomach and increase its tonus, permitting radiologic observation of the behavior of the mucous membranes and of the muscular coat. Gutmann used mainly morphine and insulin. The method has been particularly helpful in the diagnosis of early carcinoma. Apparently the first sign of a gastric carcinoma is a localized infiltration and rigidity. If peristalsis is slow and shallow, the area of rigidity may be overlooked. If, however, by means of pharmaceuticals peristalsis is markedly increased, such an area becomes more easily recognizable and the diagnosis can be made more promptly.

In the presence of extreme irritation, the pylorus may show a cramp-like spasm and the entire stomach may be contracted, preventing a close study of the mucosal pattern and behavior. In such cases, the author felt that a pharmaceutically produced relaxation of the stomach might be of value. His method, therefore, constitutes a reversal of the original work of Gutmann. He has studied tetraethylammoniumbromide (TEAB) which has an action somewhat resembling curare. It is a ganglion-blocking poison, interrupting the transition of the impulses from the nerves to the muscles. Injected intramuscularly it produces an increase in tonus after about ten or twenty minutes, followed, after a similar interval, by relaxation lasting from two to four hours. This period of relaxation affords an opportunity to study the autoplastic action of the gastric mucosa. The author gives the barium meal at the time of the injection of TEAB. In this way, it is possible to study the stomach during the phase of hyperkinesis and then, about thirty minutes later, during relaxation.

Theoretically, this method seems to have great merit, but practically it has been found that the blocking by the TEAB fails to occur in about 50 per cent of the cases. The reason for this failure has not been sufficiently clarified.

Sixteen roentgenograms.

WM. A. MARSHALL, M.D.
Chicago, Ill.

Gastric Block. A Disturbance in Gastric Motive Function. Bengt Lilja. Acta radiol. **39:** 353–367, May 1953.

Ulceration at the incisura angularis produces definite alterations in the appearance and activity of the stomach as seen on the roentgenogram. Forty-four cases of this type of ulceration were studied, 22 of which were subjected to surgical examination. When the ulcer is large (at least 1 cm. in diameter on the roentgenogram), there is an associated dilatation of the sinus of the stomach (pars pylorica). Peristalsis in this area becomes shallow and irregular. Healing of the ulcer is not followed by a reversion of pattern to normal. Histologic studies on the surgical specimens demonstrated destruction and fibrosis of the muscular wall at the site of the ulcer. It is probable that this destruction is the cause of disturbance in motor function.

Physiologists have shown that there are possibly two motor centers in the stomach: one near the cardia and the other in or near the incisura angularis. Since the incisura angularis is the focal point for the circular muscular fibers radiating to the pars pylorica, destruction of muscle fibers at this point would enhance the degree of muscular dissociation which normally occurs at the junction of the longitudinal and transverse portions of the stomach. When destruction of the fibers is great enough, as in the large ulcer, the impairment of contraction of the pars pylorica can become apparent on x-ray examination. The dilatation of the sinus probably arises from the injury to the medial longitudinal band of muscle fibers.

Noting the similarity between the changes in the stomach following this destruction of muscle fibers and the changes in the heart muscle subsequent to injury, the author uses the term "block," designating impairment of gastric motor function as "gastric block." The roentgenologic demonstration of gastric block is a measure of the extent of organic change in the gastric wall and becomes, therefore, significant in the determination of the necessity for operation.

Fourteen roentgenograms; 4 photomicrographs; 4 drawings.

RICHARD F. MCCLURE, M.D.
Palos Verdes Estates, Calif.

Torsion of the Stomach. Milan Svoboda. Acta radol. et cancerol. Bohemoslov. **7:** 91–96, April 1953. (In Czechoslovakian)

A case of torsion of the stomach in a girl of eighteen years is reported. The stomach was rotated about 90 degrees, presumably as a result of adhesions of the omentum to the cecum, following an appendectomy. The diagnosis was made radiologically and confirmed at laparotomy.

Three roentgenograms.

Gastric Diverticula. K. E. Matzinger. J. Canad. A. Radiologists **4:** 23–25, March 1953.

Two cases of radiologically demonstrable gastric diverticula are presented. In each instance surgical

exploration failed to reveal the diverticulum, despite the fact that gastroscopy had confirmed its presence in one of them.

A concise review of the incidence, clinical features, and radiologic findings in gastric diverticulosis is presented. Radiologically a sac-like out-pouching of the gastric mucosa is demonstrable, with intact mucosal rugae at the neck of the sac. Retention of barium for twenty-four hours or longer is observed.

Clinical studies and the frequent coexistence of other gastrointestinal changes indicate the importance of eliminating other possible biliary or gastrointestinal changes before attributing complaints to a recognized gastric diverticulum.

Two roentgenograms. JOSEPH P. TOMSULA, M.D.
Baton Rouge, La.

Myoma of the Stomach. A Review of 50 Cases. T. Antonie. Australian & New Zealand J. Surg. **22**: 286–296, May 1953.

Fifty cases of smooth muscle tumors of the stomach are reviewed. More than half of these were without symptoms, being found accidentally. Dyspeptic manifestations were common. Acute or chronic blood loss occurred in almost a quarter of the cases. Three patients were seen with an abdominal swelling. Perforation has been reported.

Any part of the stomach and any of its muscular layers may be the site of origin of a myoma. The tumors are variable in size and number but generally are single and small. Necrotic change, with ulceration, cavitation, and hemorrhage, was seen.

A growth cannot be designated benign or malignant with any certainty from the gross appearances Even the microscopic picture is variable in cell pattern, vascularity, and stromal content. When a malignant lesion is suspected, clinical behavior is often a more reliable index than cellular morphology.

When symptoms exist, the nature of the lesion may be suspected on clinical grounds. Radiologic and gastroscopic studies should lead to the correct diagnosis in a high percentage of cases.

Differentiation of myoma from other benign neoplasms is, as a rule, impossible without histologic examination and even then may present difficulties. Malignant myomata are mistaken for carcinoma, while occasionally an extra-gastric tumor leads to confusion.

Radiologically, a perfectly smooth, round or oval, regular barium outline contour is a feature of the innocent rather than the malignant tumor. When doubt exists, filling the stomach with air may be helpful. Calcification supports a diagnosis of innocence. The finding of uninterrupted peristalsis as a rule indicates absence of infiltration. Extragastric tumors usually have a smooth, rounded outline and cause little interference with the adjacent peristaltic movement. A pedunculated tumor arising from the outer coats of the stomach may cause indentation of the barium-outlined viscus, giving the erroneous impression of an extragastric tumor.

Individual circumstances must always be an important factor in determining the correct surgical treatment in any case. A radical removal is advised where practicable.

Twelve figures, including 2 roentgenograms and 7 photomicrographs; 3 tables

MORTIMER R. CAMIEL, M.D.
Brooklyn, N. Y.

Calcified Gastric Leiomyoma: Case Report. Lowell H. Steen and W. G. Newell. Gastroenterology **24**: 124–129, May 1953.

Calcification has been previously described in gastric leiomyoma but in no other gastric tumor. The gastroscopic picture is not characteristic and may be mistaken for cancer.

The case of a 66-year-old white man is presented An isolated episode of hematemesis for two days had occurred fifteen years previously. No further gastrointestinal symptoms were noted until just prior to admission, when severe, sharp, stabbing, left upper abdominal pain occurred, radiating into the chest and back. The pain was not affected by food and disappeared in eight or nine hours. Hematemesis was not reported. An upper gastrointestinal series showed a filling defect in the pars media of the stomach, associated with stippled calcification within and beneath the defect. At gastroscopy the aphthous type ulceration and cluster of white grape-like tissue along the greater curvature of the antrum were interpreted as a malignant gastric lesion. Laparotomy was done, and pathologic examination demonstrated calcified leiomyoma.

Four illustrations, including 1 roentgenogram.

J. MAURICE SWAIN, M.D.
Cleveland Clinic

Ulcer of the Greater Gastric Curvature. Arthur David Silk, Olov A. Blomquist, and Rudolf Schindler. J.A.M.A. **152**: 305–307, May 23, 1953.

Ulcers were found on the greater curvature of the stomach in 18 patients. Pathologic examination showed 10 of these ulcers to be malignant and 8 benign.

Benign ulcer of the greater curvature is frequently found in association with duodenal ulcer or benign ulcer of the lesser curvature of the stomach. The authors believe that the finding of such ulcers in more than one location favors a benign origin of the greater curvature ulcer. They remark upon the curious fact that 3 of the 8 benign greater curvature ulcers occurred in patients having primary pulmonary carcinoma, and that in each of the 3 instances death was due to gross hemorrhage from the ulcer.

One roentgenogram; 1 photomicrograph; 1 gastroscopic picture. ARTHUR S. TUCKER, M.D.
Cleveland Clinic

Chronic Gastric Ulcer in Childhood. A Critical Analysis of the Literature, with Report of a Case in an Eleven-Year-Old Boy. Walter M. Block. Am. J. Dis. Child. **85**: 566–574, May 1953.

The authors present a well documented case of chronic gastric ulcer occurring in an 11-year-old boy. The child gave a history of "stomach-aches" for the past two years, more recently associated with vomiting of "coffee-ground" appearance. X-ray examination demonstrated a gastric ulcer on the lesser curvature about an inch from the pylorus. A prompt clinical response to treatment with Banthine and a modified Meulengracht diet was obtained. Two weeks later a roentgen study was negative.

According to the author, a chronic gastric ulcer in childhood is one demonstrated roentgenologically, surgically, or at autopsy, in a child between the ages of one and sixteen years. It must have existed for more than a month without concomitant pathologic findings, such as burns, infections, etc., that represent possible

etiologic factors. Applying this definition to the case reports in the literature, only 39 true chronic gastric ulcers in childhood were found.

Two roentgenograms; 2 tables.

R. F. LEWIS, M.D.
Cleveland Clinic

Coexistence of Peptic Ulcer and Idiopathic Ulcerative Colitis. Bernard H. Chaiken, Bertram L. Levy, and C. Wilmer Wirts. Gastroenterology **24:** 103–108, May 1953.

The coexistence of peptic ulcer with idiopathic ulcerative colitis is considered uncommon, occurring in about 3 per cent of a large series of cases of the latter disease. The authors found a single example among 75 patients with ulcerative colitis.

A chronically ill 35-year-old white man exhibiting periods of emotional unrest and hostility gave a five-year history of recurrent diarrhea, intermittent constipation, diffuse abdominal cramping pains, and weight loss. *Endamoeba histolytica* had been demonstrated in the stools on an earlier occasion, but treatment at that time was without permanent relief. Proctoscopic examination revealed a hyperemic, diffusely granular, friable mucosa considered to be characteristic of idiopathic ulcerative colitis. No amoebae were found, despite intensive search. During the course of treatment, an upper gastrointestinal series was performed because of symptoms of burning, mid-epigastric postprandial distress. A large ulcer crater was found in the duodenal bulb. This regressed in two months following therapy, leaving residual duodenal deformity.

A possible etiologic relationship between peptic ulcer and ulcerative colitis has been suggested by experimental work showing increase in lysozyme values of the stools during periods of emotional upset (Meyer *et al.*: Am. J. Med. **5:** 482, 496, 1948). Beneficial effects of ACTH on chronic ulcerative colitis are balanced by adverse effects of this drug upon peptic ulcer. The authors suggest that patients about to receive ACTH therapy for ulcerative colitis be investigated for possible coexisting peptic ulcer. They believe that the two conditions occur together more frequently than was previously supposed. J. MAURICE SWAIN, M.D.
Cleveland Clinic

Peptic Ulcer Perforation Following Administration of Phenylbutazone. W. E. Shields, N. E. Adamson, Jr., and J. B. MacGregor. J.A.M.A. **152:** 28–30, May 2, 1953.

Multiple Gastric Ulcers Occurring During Phenylbutazone Therapy. Edward C. Raffensperger. Ibid, pp. 30–31.

Gastric Ulcer with Massive Hemorrhage Following Use of Phenylbutazone. Report of a Case. Philip Krainin. Ibid, pp. 31–32.

The three papers listed above report some unfavorable effects of the use of phenylbutazone for arthritic and rheumatoid conditions. Shields and his associates report 2 cases of perforated peptic ulcer and 1 of bleeding from a duodenal ulcer occurring in association with phenylbutazone therapy. Roentgenograms in the cases of perforation revealed free air beneath both hemidiaphragms. The multiple ulcers described by Raffensperger were also demonstrated roentgenographically, as was their disappearance on a strict ulcer regime. Roentgenograms in this case are reproduced. Krainin's case is one of massive hemorrhage in a patient with no previous ulcer symptoms. Roentgenograms show the ulcer and its subsequent disappearance. Krainin concludes that the possibility of phenylbutazone initiating ulcer formation is real. He suggests also that the use of this preparation would appear to be contraindicated in known cases of peptic ulcer because of the likelihood of reactivation and massive hemorrhage.

Spontaneous Perforation of a Benign Gastric Ulcer into the Transverse Colon: Report of a Case. William Riley Bosien and M. Dawson Tyson. Gastroenterology **24:** 113–117, May 1953.

Only 2 cases of spontaneous perforation of benign gastric ulcer into the colon have been reported in modern literature. The authors add a third.

A 45-year-old white man, a mill worker, with generalized rheumatoid arthritis, gave a history of sudden gastrointestinal hemorrhage six years earlier. A gastric ulcer of the larger curvature had been demonstrated at that time and treated medically. Later there was roentgen evidence of healing. Four years after this, abdominal discomfort and epigastric burning developed, continuing until the present admission. In the interval an acute exacerbation of the rheumatoid arthritis was treated with ACTH (4 gm. in divided doses).

At the onset of the present illness, a dull boring pain was noted to the left of the umbilicus, which was relieved by milk. Coincidentally, a normal habit of one daily stool was changed to two or three strong-smelling, liquid bowel movements daily, usually following meals. There was an 11-pound weight loss. Six weeks after onset, a barium enema demonstrated a gastrocolic fistula. Operation revealed the fistula without evidence of malignant disease.

An interesting feature of this case was the relative lack of diarrhea, such as is usually encountered in gastrojejunocolic fistulae; it is postulated that diarrhea in the latter instances is due to reflux of colon contents into the highly irritable jejunum. Although not proved, it is suggested that the well known action of ACTH in delaying normal healing may have facilitated perforation in this instance.

One roentgenogram. J. MAURICE SWAIN, M.D.
Cleveland Clinic

Postoperative Intestinal Obstruction. William S. McCune and John M. Keshishian. Surg., Gynec. & Obst. **96:** 567–572, May 1953.

A total of 46 cases of postoperative intestinal obstruction occurring within the first fifteen days after various types of surgery are reviewed. Thirty-five of the patients had a mechanical obstruction, while the other 11 showed a paralytic ileus.

Mechanical obstruction was due to a number of causes. Generalized adhesions accounted for the obstruction in 34 per cent, and adhesions at the operative site in 26 per cent. Intestinal incarceration in peritoneal defects was responsible in 29 per cent, and failure of an intestinal anastomosis to function in 11 per cent. The three most frequently recurring symptoms with mechanical obstruction were pain, vomiting, and distention. The pain was of the recurrent colic type and was frequently accompanied by peristaltic rushes. Vomiting occurred in 80 per cent of the patients while distention of some degree was found in 86 per cent.

Supine and upright roentgenograms were obtained

in all but 1 case and indicated obstruction in all instances. Only once was the erroneous diagnosis of paralytic ileus made in a case of mechanical obstruction. The important differential criterion was the presence or absence of gas within the colon in association with the small bowel distention. In 7 cases, the obstruction was caused by the protrusion of a loop of intestine into a partial disruption of the inner layer of the abdominal wound. If this is suspected, a lateral roentgenogram of the abdomen will sometimes reveal the distended loop of bowel in the abdominal wall.

The treatment of mechanical obstruction was reoperation in 29 (83 per cent); 6 patients were treated by enemas, intubation, and other conservative measures. The mortality rate in these 35 cases of postoperative mechanical obstruction was 8.5 per cent. All but one of the 11 patients with paralytic ileus were treated conservatively, with a mortality of 9 per cent.

Two roentgenograms; 1 drawing; 3 tables.

DEAN W. GEHEBER, M.D.
Baton Rouge, La.

Duodenal Atresia. William C. Beck and George Chohany. J. Pediat. **42:** 432–439, April 1953.

Duodenal atresia is a rare anomaly, occurring approximately once in 20,000 births. It is observed at three sites: (1) the obstruction proximal to the ampulla of Vater, (2) the obstruction distal to the ampulla, and (3) the ampulla involved with a secondary obstruction of the biliary tract. Of these three, the second is most frequently encountered.

Duodenal atresia results in a high intestinal obstruction. The only consistent symptom is vomiting, which invariably occurs on the first day of life. As most of the obstructions are below the ampulla, the vomitus usually contains bile. In rare instances of accompanying biliary atresia, the vomitus will not contain bile and the baby will be jaundiced. Abdominal distention may or may not be present. In the stool there is an absence of the cornified epithelial cells which are normally present.

A roentgenogram of the abdomen may be diagnostic. There is gas in the stomach and part of the duodenum, but none is present distal to the site of obstruction. The authors inject Lipiodol through a tube introduced into the stomach. The opaque material outlines the stomach and a tremendously enlarged duodenum.

Surgical procedure consists in performing an anastomosis as close to the obstructive site as possible. Two cases are reported here in which the duodenum was anastomosed with the jejunum. One of the patients died of agranulocytosis. The other is living and well.

Four roentgenograms.

HOWARD L. STEINBACH, M.D.
University of California

Barium Peritonitis. Herbert M. Olnick and William M. Watkins. J. M. A. Georgia **42:** 253–254, May 1953.

A case is reported in which a considerable quantity of barium had spilled through a perforated duodenal ulcer five years previously. The patient recovered without surgery but was re-examined because of an exacerbation of ulcer symptoms. The old films were not available, but the new ones showed the barium in nodular deposits throughout the abdomen, even between the liver and diaphragm on the right side. Re-examination of the stomach showed persistent duodenal deformity but no obstruction. The patient had no complaints which could be related to the presence of the intraperitoneal barium.

[It is a rather rare occurrence for barium to enter the peritoneal cavity, but the significant thing is the number, type, and virulence of the bacteria which accompany it, since barium itself is too inert to produce any great amount of irritation. If the patient survives the perforation of the upper or lower intestinal tract through which the barium escapes, the abdomen presents a striking roentgen appearance.—Z. F. E.]

Two roentgenograms.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Visualization of the Common Duct During Cholecystography: Its Significance. Maurice D. Sachs. Am. J. Roentgenol. **69:** 745–765, May 1953.

Despite cholecystographic demonstration of a normally functioning gallbladder, a significant number of patients with symptoms referable to the biliary system are subjected to cholecystectomy, with no permanent relief of symptoms. In an attempt to explain this phenomenon, the author made a study of the appearance of the common duct during cholecystography. He prefaces his report with a consideration of the anatomy and physiology of the gallbladder and extrahepatic biliary tract and a review of the literature.

It was believed that the common duct probably could be visualized more often if a drug with the property of constricting the sphincter of Oddi were given just prior to the fatty meal. Accordingly, morphine sulfate was given to 89 patients but in no instance was either the cystic or common duct visualized. Not only did the drug cause a spasm of the sphincter of Oddi, but the neck of the gallbladder was occluded at Lütken's sphincter. Prostigmine, a vagoconstrictor, was then used and good visualization of the ducts was obtained. At eight, fifteen, and twenty-five minutes, and at three and six hours following the fatty meal, films were taken and the extrahepatic ducts and rate of evacuation of the gallbladder were studied. In this manner the state of the sphincter of Oddi and the presence of dysfunction as reflected by the common duct could be determined.

In the presence of a peptic ulcer, the gallbladder contractions are increased and spasm of the sphincter of Oddi may occur. If this spasm is allowed to persist, inflammation and even fibrosis may ensue. In pancreatitis, there may be narrowing of the pancreatic segment of the common duct.

The author presents numerous examples of common duct narrowing and of stenosis of the sphincter of Oddi diagnosed by cholecystography.

Forty-four roentgenograms; 5 drawings.

SEYMOUR A. KAUFMAN, M.D.
Boston, Mass.

THE MUSCULOSKELETAL SYSTEM

Double Contrast Visualization of Joints. Leon O. Parker and Alfred A. deLorimier. California Med. **78:** 424–427, May 1953.

The authors describe their method of "double contrast" study of the knee. This involves first anesthetizing the synovial membrane. For this purpose, the authors use 2 per cent Metycaine, injecting it intracutaneously, subcutaneously, and within the joint. Ten minutes later sodium iodomethamate (Neo-Iopax) is introduced into the joint and spread about by manip-

ulation. Most of the medium is then aspirated and oxygen is introduced to supply the double contrast. Following the examination, the synovial cavity is washed with sterile saline to eliminate all the iodide.

Views of the knee are taken with the joint flexed, extended, abducted, and adducted, with higher than conventional kilovoltage—70–80 kv. The foot of the table is elevated 20 to 30 degrees so that any fluid will gravitate to the suprapatellar pouch; compression bandages may be applied to better distribute the gas, and traction may be used when needed.

A double-contrast arthrogram of a normal knee is presented and described. The findings in chondromalacia of the patella are roughening of its articular cartilage and irregularity of opacity in outline. The semilunar cartilage is well shown by this method. When this cartilage is detached, the opaque medium is seen adhering to the joint capsule at the site of detachment and the displaced meniscus may be identified. Examples of synovial membrane hernias are also presented.

In the 28 patients who were examined in this fashion, there was no evidence of damage attributable to the procedure. About half the patients were operated upon following examination and there was no macroscopic evidence that the synovia had been injured.

Five roentgenograms.

SEYMOUR A. KAUFMAN, M.D.
Boston, Mass.

Roentgen Manifestations of Unrecognized Skeletal Trauma in Infants. Frederic N. Silverman. Am. J. Roentgenol. **69**: 413–426, March 1953.

The author presents 3 cases, and refers to others, of bizarre radiographic bone changes in infants, related to previous traumatic episodes. The trauma was unrecognized clinically but was suggested by the roentgen examination, following which determined questioning of the parents revealed a history of purposely hidden or forgotten injury.

The lesions were in the main multiple (polyostotic) and generally asymmetric, the primary radiographic finding being marked periosteal new-bone formation with cloaking of shafts of the long bones of the extremities involved. In addition, in several instances there was either impaction or destructive change at the metaphyses, which apparently were the primary sites of trauma, the periosteal change being secondary to the metaphyseal infractions. Excellent radiographs are included to show the initial appearance of the lesions and also the subsequent course, leading to complete healing.

A rather extensive discussion of the problem follows, including a consideration of the differential diagnosis, with particular emphasis on osteomyelitis, tuberculosis, syphilis, and scurvy. Primary and metastatic bone tumors might be considered on the initial clinical examination but the radiographic appearance should exclude this diagnosis, particularly in the polyostotic lesions. The author also discusses the role of some generalized disease processes in predisposing to unrecognized bone injury, particularly the osteoporosis seen with the celiac syndrome, osteoporosis following poliomyelitis, and a tendency to long bone fracture in infants suffering from subdural hematoma. Mention is also made of the periosteal changes in the newborn occurring as a result of obstetrical injury. The periosteal cloaking described and illustrated appears to be the result of the relative ease of stripping of the periosteum because of its loose attachment in infants.

The author stresses the importance of careful but discreet questioning of the parents or guardians in order to elicit an accurate history. Emphasis upon the favorable outlook in the case of injury as opposed to the more serious prognosis of an infectious process or neoplasm may be helpful in this respect.

Fifteen roentgenograms.

MAURICE TATELMAN, M.D.
Detroit, Mich.

Leontiasis Ossea. A Critical Review, with Reports of Four Original Cases. John Evans. J. Bone & Joint Surg. **35-B**: 229–243, May 1953.

This review is based on 149 reported cases of leontiasis ossea with an additional 4 that the author investigated and treated personally. True leontiasis ossea is a generalized homogeneous swelling of the facial bones, arising usually in the first decade of life. The clinical picture shows an insidious onset of facial deformity with or without proptosis, nasal obstruction, and impairment of vision. There are two main types of the disease: (1) the sclerotic type and (2) the fibroplastic type, which includes monostotic and polyostotic fibrous dysplasia, Albright's syndrome, and multilocular cystic disease of the jaws. In addition there is a group designated false or symptomatic leontiasis, comprising Paget's disease, congenital gigantism, pituitary gigantism, craniostenosis, benign and malignant tumors of the nose and air sinuses, and syphilitic osteoperiostitis.

A history of trauma or infection is obtained in the major proportion of patients with the sclerotic type of the disease. The diploe of the cranium and the outer plate are affected. The second type is not, in general, associated with infection. The swellings are more exuberant, the bones are soft and show eggshell crackling, and usually there is more pressure on the surrounding structures, such as the eyes and the nose. The bones most commonly affected are the anterior and orbital plates of the frontal bone, orbital plate of the ethmoid, the zygoma, and the maxilla. In Type 1 cases the antra are frequently obliterated. The bones of the middle fossa show sclerosis in all cases, but especially in Type 2.

For Type 1 cases the average age of onset was 18.4 years, for Type 2, seven years. There is a history of an insidious onset of facial swelling noticed in early infancy. The swelling remains unilateral for some time, with few symptoms beyond facial pain and neuralgia. Later, at ten to fourteen years, the patient complains of nasal obstruction and proptosis. Still later there may be impairment of vision, especially a restriction of visual fields. Finally, the secondary effects produced by a large hyperostotic mass will lead to epiphora, sinus infection, and neuralgia. If the tumor is large, the skin is stretched and thin.

Radiographically the abnormality in Type 1 cases may take three forms: (1) a localized sclerosis beginning in the maxilla and spreading over the frontal bone, sometimes to the cranium and lower jaw; (2) incomplete sclerosis, etched out by small translucent patches and areas of normal bone; (3) sclerosis of the face associated with a generalized sclerosis affecting other parts of the skeleton, as in Albers-Schönberg's disease. The sclerosis may be periosteal or endosteal. In Type 2 the facial bones show the typical trabeculated cystic appearance of a localized osteitis fibrosa. The cortex may be a paper-thin shell. The base of the skull shows sclero-

sis, a characteristic finding. The calvarium is thickened and may present an appearance of Paget's disease, except that the inner table is intact. Osteoporosis circumscripta cranii occurs frequently.

The diagnosis of leontiasis ossea is based on the history of proptosis, nasal stenosis, and swelling of the face starting in the first decade of life, radiographic examination, and biopsy. The whole skeleton should be radiographed. Biopsy is important in excluding such conditions as osteoclastoma and osteitis deformans.

The prognosis is better than was previously thought. Visual lesions occur in only 20 per cent of the cases. Of 97 cases of true leontiasis ossea collected by the author, 31 showed no symptoms or signs beyond swelling of the face; in 23 there were nasal obstructions, epiphora or dacrocystitis; in 19 there were signs of local pressure on the eye or optic nerve.

Treatment is mainly symptomatic. The most important step is to check and relieve the eye signs by decompression of the optic nerve. Nasal stenosis may require treatment by resection of the septum and chiseling down the floor of the nose. Probably the commonest surgical treatment in Type 2 cases will be to restore a normal facial contour by plastic operation. X-ray therapy, alone or in conjunction with surgery, has proved to have a beneficial effect, producing regression of the bony tumor and of the symptoms. Recommended dosage is 2,000 to 3,000 r.

Four roentgenograms; 6 photographs; 1 photomicrograph.

WINSTON C. HOLMAN, M.D.
Shreveport, La.

Generalized Hyperostosis and Pachyderma. Zdeněk Mařatka and Adolf Středa. Acta radiol. et cancerol. Bohemoslov. **7:** 97–107, April 1953. (In Czechoslovakian)

The authors report a case in which generalized hyperostosis was associated with an abnormal thickening of the skin. This, they state, is the thirty-third such case to be recorded, but they do not furnish references to the others. Their patient was a twenty-seven-year-old male with disproportionate lengthening and thickening of the distal parts of all the extremities, clubbing of the fingers, and a roughening of the skin of the face, palms, and soles. The bone changes were demonstrable roentgenologically. The laboratory findings, including serum calcium, phosphorus and phosphatase determinations, were essentially normal.

Three roentgenograms; 3 photographs.

Chondrodystrophia Calcificans Congenita. Bedford H. Berrey and Cecil H. Kimball. J. Pediat. **42:** 474–477, April 1953.

A case of chondrodystrophia calcificans congenita is reported, the twenty-fourth to appear in the literature. The child had some features of mongolism and others of achondroplasia. Roentgenograms of the skull revealed an upward and outward slanting of the orbits. The nasal bones were apparently absent and a definite saddle nose was present. The hands were short and thick, and the fingers were extremely small. The toes were much the same, the third toe extending beyond the great toe bilaterally. There was a typical fleck-like appearance of calcium deposition in the hands and feet. The fibula was longer than the tibia. The epiphyseal ends of the femur and tibia were flared. Some abnormal calcification was noted along the vertebral column.

Chondrodystrophia calcificans congenita must be considered a dystrophy of the bones having their origin in cartilage, involving the epiphyseal ends of long bones, with stippled calcium deposits. Other bones where cartilage is a precursor may be similarly involved. The condition is particularly notable in the epiphyseal centers of the small bones of the hands and feet. Chondrodystrophic changes are present in the long bones and the fibular length often exceeds that of the tibia.

Six roentgenograms; 1 photograph.

HOWARD L. STEINBACH, M.D.
University of California

Xanthogranulomatous Disease of Bone with Polyarthritis. Report of Two Cases. G. N. Golden and H. G. H. Richards. J. Bone & Joint Surg. **35-B:** 275–284, May 1953.

The authors present two cases which they felt were a unique combination of pathological changes: (1) rheumatoid polyarthritis, (2) advanced cystic changes of the long bones showing histologically a xanthogranulomatous type of lesion, and (3) enormous cystic swelling of the limbs with a histologic resemblance to bone cyst.

The authors describe the radiographic appearance in the first case as similar to that in hyperparathyroidism, but the blood picture and morbid histology differentiated the condition from osteitis fibrosa. Numerous large cysts were seen in the affected bones in the neighborhood of the arthritic joints. There was well marked thinning of the cortex by absorption from the inner side. The medullary pattern was replaced in some parts by a homogeneous ground-glass appearance and in others by circular areas devoid of any bony structure or opacity. In some places large trabeculae of compact bone traversed the medullary cavity. The changes were most marked in the right ulna.

Histologically, biopsy showed three features of special interest: (1) focal necrosis, (2) multinucleated giant cells, and (3) sheets of polygonal foamy or xanthoma cells. Sudan Black stains revealed many fine droplets of fat in the xanthoma cells and abundant coarse droplets packed tightly in the giant cells.

In the second case arthritic and cystic changes were also demonstrated and histologic examination of a biopsy specimen from the ulna showed xanthogranulomatous tissue with ill-defined foci of necrosis and occasional giant cells.

These cases cannot be fitted into any of the types of lipoidosis thus far described, because of the absence of any affection of the bones of the skull and of other viscera, as well as the associated polyarthritis and cyst formation. The radiographic changes in some of the bones were suggestive of giant-cell tumor but were distinctly different clinically and pathologically.

The following observations are made: (1) Some of the granulomatous lesions in the first case showed zones of necrosis bearing a passing resemblance to that in the better known necrobiotic subcutaneous nodules now well recognized in certain cases of rheumatoid arthritis. The necrotic areas in the second case resembled pyogenic lesions that had become walled off. (2) Degenerative features in the form of eosinophilic hyaline change in collagen, together with vascular changes in the bursal lesion in Case 1 reminded one of the rheumatic and pararheumatic diseases. (3) The more cellular regions in both cases were basically granulomatous and contained fat-laden cells, but nevertheless bore a strong resem-

blance to the lesions described in the xanthomatous phase of Hand-Christian-Schüller disease. In short, practically all of the histologic features described in the bones and bursae can be found in the normocholesteremic group of lipoidoses now considered different stages of the same disorder, namely Letterer-Siwe disease, eosinophilic granuloma, and Hand-Christian-Schüller disease. (4) "Xanthoma" or "foam" cells are by no means pathognomonic of the lipoid reticuloses, and similar structures are often observed in traumatic fat necroses of the breast and in the vicinity of old ovarian hemorrhages, in hydrosalpinx, and in degenerating colloid adenomas of the thyroid where hemorrhage has occurred. (5) Abnormal thymol tests, suggesting parenchymatous damage in the liver, and the rising blood cholesterol, suggesting a disturbance of cholesterol metabolism, in the second case, are probably significant. They at least suggest that the disease process is not confined to the joints and juxta-articular tissues.

It is the authors' belief that polyarthritis accompanied by xanthogranulomatous lesions in adjacent bones and soft tissue is not as rare as it may seem. Many cystic lesions of bone are noted radiologically which never come to a detailed histological examination.

Nine roentgenograms; 6 photomicrographs; 2 tables.

WINSTON C. HOLMAN, M.D.
Shreveport, La.

Septic Arthritis and Osteomyelitis in Infancy. Seymour Heymann, I. Kessel, Harris Jackson, S. N. Javett, and J. L. Braudo. J. Pediat. **42:** 561–569, May 1953.

Septic arthritis and osteomyelitis in infancy present a clinical picture of painful, red, hot swelling in the region of one or more joints. There may be absence of pyrexia and general reaction to infection, but this must not be allowed to confuse the diagnosis.

Six cases are here reported; 3 in the neonatal period and 3 in infants. Marked leukocytosis was found in only 4 cases. Pus was aspirated from the joints in 4 cases, of which 2 yielded sterile cultures. All of these infants were treated with penicillin.

Roentgenograms made when the cases were first seen revealed no changes in the bones in 4 of the 6 infants. However, periosteal reaction, bone destruction, or both appeared between the eighth and the thirty-first day of the disease. The other 2 children showed destruction of bone when first seen, on the ninth and twelfth day of the disease, respectively.

The follow-up roentgenograms showed enlarged epiphyses in 2 children. Coarsening and irregularity of the trabecular pattern of bone with slight deformity were found in the other two.

Eight roentgenograms; 2 tables.

PAUL W. ROMAN, M.D.
Baltimore, Md.

Infantile Cortical Hyperostosis (Caffey-Smyth Syndrome). Report of a Case in a Negro Infant. Melvin E. Jenkins and Roland B. Scott. J. Pediat. **42:** 586–588, May 1953.

A rather typical case of infantile cortical hyperostosis in a Negro child is reported. At four months of age, swelling of the face and fever were noticed. Irritability was marked and the child cried when the face was touched or the right arm moved. The facial swelling subsided somewhat but returned again at the age of six months. At this time there was swelling of both cheeks and the jaw, but no redness, excess heat, or fluctuation. Laboratory tests were normal. Roentgen examination of the entire skeleton showed hyperostosis of the mandible and scattered cortical hyperostosis of a clavicle, a tibia and fibula, and both ulnae. No specific treatment was given. The patient was improving during a two month follow-up.

Three roentgenograms; 1 photograph.

PAUL W. ROMAN, M.D.
Baltimore, Md.

Simultaneous Occurrence of Fibrous Dysplasia (Jaffe-Lichtenstein) and Extra-Osseous Fibromyxomata. K. Braunwarth. Fortschr. a d. Geb. d. Röntgenstrahlen **78:** 589–594, May 1953. (In German)

Extra-osseous fibromyxomata are rare. They occur in the striped musculature, are said to originate from the intermuscular connective tissue, and are found chiefly in the muscles of the thigh.

A 56-year-old patient had a painful lump the size of a fist along the outer side of the left thigh which had been developing during the past year. The tumor was easily movable against the bone. The x-ray film showed changes within the femur that were consistent with fibrous dysplasia. These bony changes were quite close to the palpable tumor. The rest of the skeleton showed nothing abnormal. The mass was removed and a biopsy of the femur was also done. The tumor proved to be a fibromyxoma, while the changes in the bone of the femur were those of fibrous dysplasia.

A study of the literature revealed 3 other cases in which a fibromyxoma was found in close proximity to fibrous dysplasia of the bone. One case record was published by Uehlinger in 1940 (Virchows Arch. f. path. Anat. **306:** 255), another by Krogius in 1928 (Arch. chir. scandinav. **64:** 465), and a third was presented before the Deutschen pathologischen Gesellschaft by Folke in 1926. In the last 2 cases, the microscopic diagnosis of the bony changes was osteitis fibrosa, which is understandable, since the term "fibrous dysplasia" (Jaffe-Lichtenstein) was not then in use. The microscopic changes of osteitis fibrosa and fibrous dysplasia are practically identical.

The author believes that in view of the rarity of extra-osseous fibromyxomata, the simultaneous occurrence of fibrous dysplasia in these 4 cases cannot be merely coincidental. In all 4 cases, the fibromyxoma grew rather rapidly, yet it was benign. It occurred beyond the period of growth of the patient and the two lesions were close together yet definitely separated.

Fibromyxomata also occur in another disease which seems to be closely related to fibrous dysplasia, that is, neurofibromatosis (von Recklinghausen). The latter disease is often associated with the appearance of coffee-colored nevi and various endocrine disturbances, mainly pubertas praecox. These very symptoms, however, are also found in Albright's syndrome and in fibrous dysplasia. Mackenzie (Brit. J. Radiol. **23:** 667, 1950) believes that neurofibromatosis is a neuroectodermal dystrophy, perhaps with some addition of mesodermal elements, while fibrous dysplasia is primarily a disturbance of the mesoderm. He believes that the connecting link between the two is Albright's syndrome.

Three roentgenograms; 4 photomicrographs.

WM. A. MARSHALL, M.D.
Chicago, Ill.

Rare Dislocations and Fracture-Dislocations. H. Fietz. Fortschr. a. d. Geb. d. Röntgenstrahlen **78:** 594–600, May 1953. (In German)

The author describes a few rare dislocations and presents case records illustrative of each.

Dislocation of the Semilunar Bone of the Wrist: A 47-year-old man riding a motorcycle hit a heavy truck. He suffered a fracture of the base of the skull and died shortly afterward. A routine x-ray examination disclosed a dislocation of the semilunar bone of the left wrist. The postero-anterior view fails to show the semilunar bone, while the lateral view shows it to be completely displaced and lying anterior to the radius about an inch proximal to the wrist joint.

Ordinarily, a dislocation of the semilunar bone is produced by a strong force upon the volar surface of the dorsiflexed hand in the direction of the forearm bones. Due to the force, the ligaments holding the bone in place are torn and the bone is usually displaced anteriorly. Only rarely, as in this case, is it completely dislodged. Both conservative treatment, with replacement of the bone, and surgical removal have been recommended. [According to the abstracter's experience, surgical removal is much to be preferred, since the semilunar bone, torn loose from its attachments, is deprived of its circulation and is likely to undergo aseptic necrosis.]

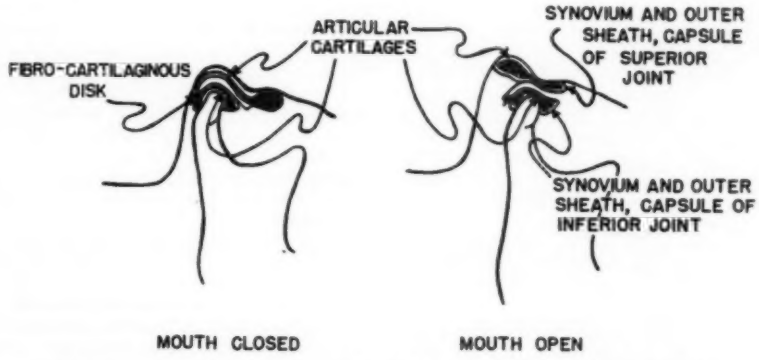
Bilateral Fracture of the Talus with Dislocation: If a strong force is applied to the sole of the foot while it is held in maximal dorsiflexion, the sharp anterior edge of the joint surface of the tibia will dig into the neck of the talus and chisel the head of that bone away from the body. This is the usual mechanism of a fracture of the talus. Under these conditions, the ligaments between the talus and the os calcis may tear, with forward dislocation of the foot while the body of the talus retains its normal relationship within the fork of the tibia and fibula, or the tibia and fibula may retain their normal relationship to the foot while the body of the talus slips out posteriorly. It may then be rotated, if the ligaments between the talus and the os calcis are still intact, or it may be entirely loose if these ligaments are ruptured. In the latter case, the body of the talus very often undergoes an aseptic necrosis. The author describes a case of bilateral fractures of the talus with backward dislocation of the body.

Posterior Dislocation of the Femur: A 64-year-old man fell from a tree and immediately experienced severe pain in the left hip. The left hip joint and left knee joint were flexed. The leg was inwardly rotated. X-ray examination showed a posterior dislocation of the head of the femur. The posterior rim of the acetabulum was broken off and also displaced. According to Schinz, these traumatic dislocations are relatively rare. Two-thirds of the dislocations occur posteriorly and one-fourth anteriorly, while the remainder are central dislocations. In the posterior dislocations the round ligament is always severed and the other ligaments are torn to some extent.

Isolated Fracture and Dislocation of the Radius: A 47-year-old woman fell and landed on the elbow. A huge hematoma developed, and there was complete loss of motion in the elbow joint. The x-ray films showed an isolated fracture of the head of the radius, with ulnar and volar dislocation of the head. Ordinarily a fracture of the head of the radius occurs through an indirect force. The capitulum of the humerus is forced against the head of the radius and chips off a part of the edge (so-called chisel fracture). Sometimes the head is fractured at the neck. If a dislocation occurs, it is almost always toward the radial and dorsal side. The unusual feature in this case was the displacement toward the ulnar and volar side.

Twelve roentgenograms.

WM. A. MARSHALL, M.D.
Chicago, Ill.


ARTICULAR CARTILAGES
FIBRO-CARTILAGINOUS DISK
SYNOVIUM AND OUTER SHEATH, CAPSULE OF SUPERIOR JOINT
SYNOVIUM AND OUTER SHEATH, CAPSULE OF INFERIOR JOINT
MOUTH CLOSED
MOUTH OPEN

Temporomandibular joint as seen in the lateral projection. (de Lorimier)

Arthropathies of the Temporomandibular Joint. Roentgenologic Aspects. A. A. de Lorimier. Am. J. Surg. **85:** 616–625, May 1953.

The temporomandibular joint is unique; its anatomy is complicated and an adequate roentgenologic study is difficult. The articulation is between the anterosuperior surface of the condyle of the mandible and the postero-inferior surface of the mandibular eminence and adjacent anterior half of the glenoid fossa of the temporal bone (see accompanying illustration).

In addition to fibrocartilaginous articular cartilage lining the opposing bony surfaces, the temporomandibular joint also contains an interposed disk of fibrocartilage, a meniscus similar to that found in the knee. This divides the joint in most instances into two distinct compartments, which have been designated the "meniscotemporal joint" and the "meniscocondylar joint."

The temporomandibular joint is a ginglymo-arthrodial, or hinge-sliding, joint. The condyle moves not only a considerable distance lengthwise over the

mandibular eminence but also there is lateral excursion of the mandibular condyle.

The joint is lined internally by synovial membrane and supported peripherally by the capsular, temporomandibular, and sphenomandibular ligaments. The muscles of mastication, the temporalis, masseter, and internal pterygoid, which clench the jaw, and the external pterygoid and platysma, which open the jaw, serve as peripheral investment. The thick pad of the parotid gland lies lateral to the joint, and a small lobule of the gland actually extends into the posterior portion of the joint. This explains the intimate relationship of these structures. Branches of the fifth cranial nerve innervate the joint.

Roentgenologic study of the temporomandibular joint is made difficult by the overlying skull and maxillofacial bones. Exaggerated nose-forehead or fronto-occipital projections are suggested for anteroposterior or postero-anterior views. With the aid of Bullitt's mastoid stereoscopic changer, excellent open and closed mouth studies can be obtained. The anteroposterior oblique projection is also of value. Tomography and contrast studies may be done. This last procedure is not without risk; oily media should never be used.

Clinically, embryologic malformations are rare. Developmental defects resulting from infection or fracture early in life are of somewhat greater incidence. Still's disease and extension of middle ear or mandible bone infections may result in inhibition of growth and necessitate plastic repair. Osteochondritis, rheumatic fever, allergic arthritis, gout, ochronosis, primary neoplasms and changes due to nerve deficiencies have not been reported to involve the temporomandibular joint. Rheumatoid arthritis, infectious arthritis, dislocations, and osteoarthritis warrant particular consideration.

Rheumatoid arthritis involves the temporomandibular joint in 50 per cent of patients with this disease. The changes range from limitation in range of opening the jaw to actual ankylosis. Roentgenograms may reveal lack of excursion of the condyle, deossification of adjacent bones, irregularities of opposing cortices and narrowing of the joint space, indicating dissolution of articular cartilages.

Involvement of the joint by infectious arthritis may be due to extension from the middle ear, infected teeth, or compound fractures. It may reach the joint by a hematogenous route or directly during contrast studies or local anesthesia. Roentgenologically this type of arthritis is characterized by limitation of motion on the affected side, increase in joint space (due to fluid), hyperemic deossification, and ultimately erosion of the articular cortex. There may be found evidence of actual osteomyelitis of adjacent osseous structures.

Dislocations of the temporomandibular joint are relatively common. Most often the condyle of the mandible is shifted anterior to the mandibular eminence. A shallow glenoid fossa or mandibular eminence and a loose joint capsule may predispose to repeated dislocations.

Osteoarthritic changes may result from any of the three major conditions just described or may follow abnormal development of the mandible or repeated minimal trauma. Dental deficiencies are also important etiological factors in this type of change in the temporomandibular joints.

Thirteen roentgenograms; 4 photographs; 1 diagram.

SEYMOUR A. KAUFMAN, M.D.
Boston, Mass.

Contribution to Congenital Syphilis. Z. Gregor and M. Kovářová. Acta radiol. et cancerol. Bohemoslov. **6**: 139–148, December 1952. (In Czechoslovakian)

A three-month-old female infant presented extensive manifestations of osseous syphilis: periostitis, osteitis, osteochondritis, marginal and central osteomyelitis. An unusual feature was osteomyelitis of the nasal bones. Treatment was by means of penicillin. The importance of the Jarisch-Herxheimer reaction in penicillin treatment of congenital syphilis is stressed, and means to avoid it are discussed.

Five roentgenograms; 2 photographs.

ERNST A. SCHMIDT, M.D.
Denver, Colo.

Motion of the Lumbar Spine. A Roentgenologic Study. Stanley S. Tanz. Am. J. Roentgenol. **69**: 399–412, March 1953.

The author reports roentgenographic studies of lumbar spinal motion—to-and-fro and lateral bending—in 10 children under the age of thirteen and 45 adults over the age of thirty-five. Motion at various levels and with various degrees of bending was determined.

Individual variations in mobility were so great that it was considered impossible to obtain a truly normal pattern. The range of lateral bending motion was found to average two-thirds that of to-and-fro motion, while rotatory motion in several instances was considerable. These findings are at variance with the observations of others, who have regarded lateral and rotatory motion as insignificant.

There was a definite decrease in the amount of motion with increasing age between thirteen and thirty-five years of age, but beyond this the change was not very significant.

Motion at the fifth lumbar interspace on lateral bending was considerably less than at other interspaces throughout the series.

History of previous low-back pain could not be correlated with any significant decrease in mobility of the spine. (None of the subjects chosen had symptoms of back pain at the time of the examination). Nine of the 45 patients showed no lumbosacral motion but this was not correlated with age or earlier back pain.

Decreased range of motion at one interspace was associated with decreased motion at all interspaces and decreased motion in one plane was associated with decreased motion in the other plane, indicating that the decrease in mobility was a generalized process.

It was demonstrated that the center of motion in both to-and-fro bending and lateral bending lies outside the articular facets, being anterior to the facets in to-and-fro bending and medial to the facets in lateral bending, a point previously demonstrated by others.

Eight roentgenograms; 7 graphs; 21 drawings; 3 tables.

MAURICE TATELMAN, M.D.
Detroit, Mich.

Roentgen Diagnosis of Rare Malformations of the Cervical Spine. C. Buetti. Radiol. clin. **22**: 141–161, May 1953. (In German)

Buetti describes in detail 5 unusual malformations of the cervical spine which are of interest not only embryologically and anatomically but also clinically and legally.

In the first patient, a 20-year-old man in whom meningismus occurred after cranial trauma, the roentgenograms showed absence of the posterior arch of the atlas. At the normal site of the arch was a triangular shadow of bone density which was unconnected with the anterior half of the atlas. Prior to his accident, the patient had experienced no neurologic or static symptoms in spite of this marked malformation.

In the second case, in a 43-year-old man, congenital torticollis had been diagnosed clinically. Anteroposterior roentgenograms and ventrodorsal tomograms demonstrated an incomplete sagittal fissure in the body of the second cervical vertebra, which was abnormally widened. The atlanto-epistropheal articulations lay at different levels bilaterally. There was bi-partition of the odontoid process.

In the third patient, a 57-year-old woman without history of previous injury, x-ray examination showed a wart-like protuberance instead of the odontoid process and above this protuberance, separated from it by a horizontal fissure, a small triangular bone shadow. This shadow seemed to be connected with the lateral masses of the atlas by longitudinal calcifications. Severe arthrosis of the left atlanto-epistropheal articulation as well as of the right intervertebral joint between C-3 and C-4 was also present. There were spondylotic and chondrotic changes of the cervical spine from C-4 downward; the lordotic curve was straightened; flexion and extension were poor.

In the fourth case, in a 62-year-old man with suspicion of tumor metastases, the x-ray examination revealed fusion of the atlas and the occiput; the lateral masses of the atlas continued directly into the occipital base. The intervertebral articulations between C-2 and C-3 and C-3 and C-4 could not be visualized.

The fifth patient was a 26-year-old man who complained of stiffness of the neck, pain on anterior flexion of the head, dizziness and occasional vomiting, having their onset a month earlier and growing progressively worse. Cerebellar exploration with subsequent decompression was eventually undertaken. No tumor was found but increase in the volume of the medulla oblongata, the upper cervical cord, and the cerebellar tonsil was diagnosed. The x-ray examination showed absence of the left arch root and of both left articular processes of the 5th cervical vertebra; only small bony rudiments were seen on the left side of the vertebra, extending posteriorly and laterally. The arch of the vertebra was open, and there was a bony connection between the loose left rudiment of the arch and the spinous process of C-4. The left superior articular process of C-6 was abnormally long, reaching as far as the region of the arch of C-4 but not articulating with its left inferior articular surface. In spite of the neurologic findings and the operative diagnosis of enlargement of the medulla oblongata and the upper portion of the cervical cord, tumor destruction of C-5 is to be excluded. Similar instances of partial defect of spinal arches have been described by Hadley (Am. J. Roentgenol. **55**: 193, 1946) and others.

Eighteen roentgenograms.

ERNST A. SCHMIDT, M.D.
Denver, Colo.

Spinal Complications Following Lumbar Puncture. A Review of the Literature and Report of Four Cases. S. Frank Redo. Surgery **33**: 690–701, May 1953.

Four cases of injury of the spine with accompanying osteomyelitis following lumbar puncture are reported. This brings to 57 the total of recorded cases of injury of an intervertebral disk or vertebra subsequent to spinal puncture (including 1 case in which there was involvement of the spinous process rather than the vertebral body). In most instances the injury was associated with difficult spinal puncture.

The signs and symptoms of spinal injury in the recorded cases are strikingly similar. Immediately following the spinal puncture, or as late as six months afterward, the patient complains of low-back pain with or without radiation down the thighs, limitation of motion of the lumbar spine, weakness of the back muscles, and difficulty in walking, stooping, and lifting. Physical examination reveals rigidity of the spine, loss of lumbar lordosis, spasm of the erector spinae muscles, and tenderness over the lumbar spines. Roentgen changes consist chiefly in thinning of the involved intervertebral disk, narrowing of the space between respective vertebral arches and interarticular facets, together with sclerosis of the vertebral bodies. Rarefaction and destruction of the vertebral bodies are also seen.

The type and extent of the injury caused by the puncture needle is more important in regard to the rapidity of the onset of the symptoms than is the age of the patient or the purpose of the puncture. The necessity for sterile technic and careful introduction of the needle is emphasized. Utilization of a different level should be practiced if spinal fluid is not obtained easily at the original puncture site.

Treatment of spinal injury following lumbar puncture depends on the presence or absence of infection. If there is no evidence of osteomyelitis, immobilization of the involved portion of the spine is all that is required. If osteomyelitis develops, antibiotic therapy in addition to immobilization is necessary.

Five roentgenograms; 2 tables.

Nontraumatic Subluxation of the Atlanto-Axial Articulation. Report of a Case. Felix Stein, Harry Bloch, and Abel Kenin. J.A.M.A. **152**: 131–132, May 9, 1953.

The authors report a single case of non-traumatic subluxation of the atlanto-axial articulation occurring one week after an upper respiratory infection in a 7-year-old boy. Roentgen examination revealed a 3 mm. shift of the atlas to the right, widening of the left atlanto-axial joint, reversal of lordosis of the cervical spine, and slight anterior displacement of the atlas on the axis.

The anatomy of the atlanto-axial articulation is briefly described and several theories of the etiology of non-traumatic subluxation are discussed. In the case presented the authors suggest that the causative factor was a joint effusion due to hypersensitivity [presumably to antibiotics, which had been administered for the respiratory infection].

Three roentgenograms.

JOHN J. CRAVEN, M.D.
Cleveland Clinic

Blastomycosis and Actinomycosis of the Spine. George J. Baylin and John M. Wear. Am. J. Roentgenol. **69**: 395–398, March 1953.

Blastomycosis of the spine produces radiographic changes almost indistinguishable from tuberculous spondylitis. The lesions are almost entirely destructive in nature, with associated collapse of vertebral bodies

and intervertebral disk involvement. Spread by dissection along the vertebral column occurs, as in tuberculosis, with paravertebral abscess formation both in the thoracic and lumbar regions. In the lumbar region a psoas abscess is common, just as in tuberculosis. Rib involvement by direct extension or pressure erosion also occurs in blastomycosis. In the absence of distinctive radiologic and clinical findings, immunological tests for the diagnosis of blastomycosis are essential.

Actinomycosis primary in the spine may produce destructive lesions, with a typical "soap-bubble" appearance of the vertebral bodies due to multiple small areas of rarefaction surrounded by zones of normal or slightly sclerotic bone. Collapse of the vertebral body and intervertebral disk involvement do not occur, and paravertebral soft-tissue swelling is inconspicuous. When the spinal involvement is secondary to actinomycosis in the soft tissues, particularly in the abdomen, dense, long spurs are formed, frequently bridging the vertebrae, with associated dense sclerosis of the lateral aspects of the vertebral bodies. The findings are considered to be secondary to involvement of the psoas muscle. They appear to be somewhat different from the usual hypertrophic changes of a degenerative nature seen in the spine. The diagnosis is facilitated by a history of chronic illness and previous abdominal surgery, usually with the diagnosis of appendicitis or inoperable cancer. The presence of sulfur granules in draining sinuses or fistulas may make the diagnosis more simple, but the organisms are not always easily found.

The authors make the point that the finding of Actinomyces does not necessarily implicate the organism as a causative agent, since it has been reported in some cases where Hodgkin's disease and brucellosis were the primary underlying diseases.

Four roentgenograms. MAURICE TATELMAN, M.D.
Detroit, Mich.

Concerning Eighty Disk Opacifications. Interest and Indications of Discography. R. De Haene. J. de radiol. et d'électrol. **34:** 325–331, 1953. (In French)

The purpose of discography is to obtain precise diagnostic information which may not be procured by other methods, as neurologic examination, standard radiography, and myelography. No appreciable complications have followed discography in animals or in man. Perhaps the only contraindication to its use is the presence of infectious spondylitis.

Normal discography shows two types of opacification: (1) nucleography proper, in which the gelatinous nucleus imbibes the opaque substance, giving an image resembling a date seed; (2) perinucleography, in which the nucleus is surrounded by the opaque substance, giving rise to two opaque plaques above and below the true nucleus.

Three types of lesion are revealed by discography. (1) There may be herniation of the nucleus through the fissured annulus fibrosus, with or without rupture. Injection in these cases should not be difficult. If the herniation is near the mid-line the injection may not be painful; if the nuclei project near a nerve root, pain will result. (2) The nucleus may protrude posteriorly, or even anteriorly, without breaking through the annulus. (3) Disk degeneration shows a space totally disorganized. The cavity is flattened and irregularly spread out on the vertebral surface. Combinations of the three types may occur.

The interest of discography springs from the correlation of clinical and radiographic results and from the presence of absence of pain upon injection of the nucleus. When injection reproduces the patient's pain, removal of the disk usually affords relief. When the injection is not painful, simple disk removal does not afford relief. In some of these cases, bone grafting to stabilize the spine is indicated and may relieve symptoms. [Actual statistics correlating clinical relief and results of discography are not presented. These are greatly needed.—C. N.]

Nineteen roentgenograms. CHARLES NICE, M.D.
University of Minnesota

Calcifying Enchondroma of Long Bones. W. Laurence and E. L. Franklin. J. Bone & Joint Surg. **35-B:** 224–228, May 1953.

The authors present 5 cases of calcifying enchondroma of the long bones. Roentgenograms show a sharply defined granular or flocculent deposit of dense calcium in the medulla in or adjacent to the metaphysis. Normal cancellous bone surrounds the calcium deposit. There is no change in size or shape of the bone, nor is there any periosteal reaction. In all except 1 of the 5 cases the condition produced no symptoms and was discovered accidentally.

Calcifying enchondroma must be distinguished from endosteal sarcoma, Brodie's abscess, and benign chondroblastoma of the bone. If there is any doubt as to diagnosis a biopsy should be performed. The biopsy of a calcifying enchondroma shows characteristic giant cells and cartilage cells.

Eleven roentgenograms.

WINSTON C. HOLMAN, M.D.
Shreveport, La.

The Os Paracuneiforme. Some Observations on an Example Removed at Operation. A. B. Morrison. J. Bone & Joint Surg. **35-B:** 254–255, May 1953.

As originally described, the os paracuneiforme is an ossicle lying in a hollow on the medial side of the foot, between the navicular and medial cuneiform bones. A case is reported here in which the accessory bone lay against the medial surface of the medial cuneiform, with which it articulated. On operation the bone was found to be partly incorporated in the tendon of the tibialis anterior.

Since the roentgenogram in this case showed no evidence of a traumatic or pathologic origin, the bone is explained as an anomaly of ossification. Normally the medial cuneiform is ossified from a single center, but ossification of the prominent medial part of the bone from a secondary center, analogous to the occasional secondary center for the tuberosity of the navicular, is a possibility. Such a center, lying in close relation to the tendon of the tibialis anterior, might fuse with the main part of the bone, giving rise to a true traction epiphysis; or, remaining separate, to an ossicle which might be regarded as a sesamoid body or an ununited traction epiphysis.

One roentgenogram. WINSTON C. HOLMAN, M.D.
Shreveport, La.

The Torn Achilles Tendon in the Roentgenogram. Detlev Schoen. Fortschr. a. d. Geb. d. Röntgenstrahlen **78:** 604–606, May 1953. (In German)

If a soft lateral x-ray film of the ankle and lower half

of the leg is studied, a dark soft-tissue shadow, triangular in shape, can be seen anterior to the Achilles tendon, formed by the loose connective tissue and fat in this area. The base of this triangle is the upper edge of the os calcis. One of the sides is the sharply outlined anterior surface of the Achilles tendon, and the other side is the edge of a group of muscles (tibialis posterior, flexor digitorum longus, and flexor hallucis longus) attached to the posterior surface of the tibia and held together by the ligamentum lacinati. If the Achilles tendon is severed, the sharp posterior outline of this triangle is disturbed and the outline becomes quite irregular. The area of the tear can be clinically felt as an indentation in the soft tissues.

The author describes the case of a patient who stumbled and injured her foot. The family doctor made a diagnosis of sprained ankle and treated the injury with compresses for four weeks. When the patient was finally admitted to the hospital, the roentgenogram showed a typical irregularity of the posterior surface of the soft-tissue triangle described above, and a definite indentation could be felt, about three fingers above the os calcis. The patient was operated upon and the torn tendon was repaired. Films taken months after the injury still failed to show the straight normal line of the Achilles tendon. This is explained by the persistence of a peritendinitis which interfered with the sharp delineation of the anterior edge of the tendon.

Five roentgenograms. WM. A. MARSHALL, M.D.
Chicago, Ill.

THE GENITOURINARY SYSTEM

Perirenal Air Insufflation by Paracoccygeal Method. Samuel H. Rothfeld, Frank C. Hamm, and Harrison C. Harlin. J. Urol. **69**: 721–725, May 1953.

Artificial retroperitoneal emphysema has a definite place in the diagnosis of adrenal, renal, perirenal, retroperitoneal, and perivesical disease. The paracoccygeal method of insufflation is preferred to the lumbar approach because of freedom from danger of pneumothorax or air embolus and because of the bilateral distribution of air.

Under local anesthesia, a spinal needle is directed from a point 1-1/2 inches from the mid-line and at the level of the mid-coccyx anteriorly and medially until the lateral edge of the coccyx is felt. The point of the needle is then directed anteriorly along the side of the coccyx until it rests in the mid-line between the coccyx and the rectum. A finger is placed in the rectum at the beginning of the procedure for the purpose of palpating the point of the needle. Inadvertent perforation of the rectum is thus avoided, and the crepitation of the injected air can be felt. After injection of 1,000 c.c. of air, oxygen, or gas, the needle is withdrawn. Collodion is applied to the skin wound. Roentgenograms are made immediately.

The authors used this method in over 200 cases without mishap. In one case there was shoulder pain after the introduction of 500 c.c. of air, but redirection of the needle permitted injection of an additional 500 c.c. without complaint. In occasional cases mediastinal pressure and neck or scrotal crepitation occurred, without untoward effects.

Eight roentgenograms; 1 drawing.
RICHARD F. MCCLURE, M.D.
Palos Verdes Estates, Calif.

Effect of Diphenhydramine (Benadryl®) on Side-Reactions in Intravenous Urography. Solomon R. Bersack and Thomas E. Whitaker, Jr. Arch. Int. Med. **91**: 618–625, May 1953.

Many writers believe that a fair proportion of the side-reactions to iodopyracet (Diodrast), as used for intravenous urography, have an allergic basis. In the light of the present trend to incriminate histamine as the means by which allergic phenomena are mediated, a study was undertaken to determine the effect of administering an antihistaminic just prior to Diodrast injection.

One hundred patients were given 20 mg. of the antihistaminic diphenhydramine hydrochloride (Benadryl hydrochloride) intravenously just before the injection of 30 c.c. of iodopyracet for intravenous urography. The antihistaminic effects of the Benadryl were evidenced by only a suggestive slight amelioration in the severity of allergic manifestions and by a slight decrease in their frequency, from 6 per cent in the 100 control patients to 4 per cent in the Benadryl group.

The effect of Benadryl was much more pronounced on those reactions which are not definitely of an allergic nature. Its antiemetic action diminished the incidence of nausea and vomiting from 17 per cent in the control group to 2 per cent in the treated group.

Side reactions to Diodrast in the allergic category occurred more frequently in patients with an allergic background. The 2 patients who had the most severe allergic reactions had positive intraocular sensitivity tests prior to the injection.

Because of the mildness of reactions to Diodrast, the routine use of Benadryl is not warranted either for the antiemetic or for the antihistaminic properties of this drug.

Five tables. HOWARD L. STEINBACH, M.D.
University of California

A Roentgenographic Classification of Tuberculous Lesions of the Kidney. John K. Lattimer. Am. Rev. Tuberc. **67**: 604–612, May 1953.

In order to determine the effectiveness of treatment of renal tuberculosis, a classification of the anatomic extent of the disease is necessary for accurate comparative studies. The classification presented here is based on the anatomic extent of the disease as found on retrograde and intravenous urograms. Five groups are listed: Group 0: No roentgen abnormality visible, but ureteral urine positive for tubercle bacilli. Group 1: Definite slight abnormality, but not diagnostic for tuberculosis (includes slight calyceal distortions and irregularities of pelvis or upper ureter). Group 2: Changes characteristic of renal tuberculosis in one calyx only. Group 3: Involvement of two calyces as in Group 2. Group 4: Three or more calyces involved (includes, also, the massive lesions). Ureteral urine must be positive for tubercle bacilli in each case. Smears positive for acid-fast bacilli were not accepted for purposes of classification, but were used in clinical practice as a valid reason for initiating treatment.

In the present study it was found that the patients in Group 0 had a favorable prognosis even before the advent of chemotherapy. Patients with medium-sized lesions (Groups 1 and 2) were found to have a more favorable prognosis than those with large lesions (Groups 3 and 4), with the chances of failure of treatment varying directly with the size of the lesions as determined by roentgenographic methods. This classifi-

cation has been used for six years and has proved reasonably satisfactory.

Eleven roentgenograms; 2 photographs.

JOHN H. JUHL, M.D.
Minneapolis, Minn.

Hydatid Cyst of the Kidney. A Report of Two Cases. E. R. Reay and G. L. Rolleston. Australian & New Zealand J. Surg. **22:** 268–272, May 1953.

Two cases of hydatid infestation of the kidney are reported in young farmers in their mid-thirties who had presumably handled sheep and dogs. In both cases there was a spontaneous evacuation of the hydatid material in the urine and not until this occurred was the diagnosis made. Each patient had recurrent renal colic. The defects in the calyceal and ureteral patterns as visualized roentgenographically were non-specific, being due to the mechanical anatomic effects of the cysts. The Casoni and complement fixation tests became positive only when the diagnosis was obvious.

The earlier isolated attacks of colic in these cases are thought to have been due to the detachment of small unrecognized pieces of the exposed laminated membrane of the cysts, while the major attacks of pain are attributed to rupture of the sac and lodgment of the expelled contents in the lower ureteric segment.

In patients suffering from ureteral colic of unknown origin who come from parts of the world where hydatid infestations are endemic, hydatid elements, hooklets and scolices should be sought for in the urine.

Six roentgenograms; 1 photograph.

MORTIMER R. CAMIEL, M.D.
Brooklyn, N. Y.

Roentgen Interpretation of Vesiculograms. Athayde Pereira. Am. J. Roentgenol. **69:** 361–379, March 1953.

The author, who is Professor of Clinical Urology at the University of São Paulo, describes his personal experience with seminal vesiculography in an undisclosed number of cases. The patients were under irrigation treatment for inflammatory disease of the seminal vesicles.

Neo-iodipin, Lipiodol, Uroselectan, Perabrodil, and Thorotrast were used as contrast media, and the vesicles were injected *via* the catheterized ejaculatory ducts or the vasa deferentia. The technic for each method is outlined. One to 3 c.c. of opaque material is injected on each side depending on the capacity of the vesicles. Axial and antero-posterior films are taken. When the differential route is used, the urethra is sounded and the bladder irrigated to eliminate contrast material which may have entered it before films are exposed.

Among the *congenital anomalies* demonstrable by vesiculography are: unilateral or bilateral absence, hypoplasia, and duplication of the seminal vesicles; communication of one or both vesicles, the vas deferens, or ejaculatory duct with the ureter; stenosis, fusion, or absence of one or both ejaculatory ducts.

In *acute inflammation*, the edema of the wall and mucosa permits only a slender thread of contrast material within the vesicle. Likewise, deep *chronic inflammation* results in a constricted lumen, with non-visualization if the lumen is completely obstructed. With superficial chronic inflammation there are no recognizable changes in the vesiculogram. *Empyema* is manifested by a distended, smooth-walled vesicle, but the same situation prevails in uninfected "cystic dilatations" with obstruction of the ejaculatory duct. Distinction between inflammatory and congenital stenosis of the ejaculatory ducts with resultant dilatation of the vesicles is made by palpation and clinical symptomatology.

Many cases thought to be prostatic abscesses were shown to be empyema of the vesicle which had opened into the prostatic urethra.

Intrinsic neoplasms may produce filling defects, or may constrict or obstruct the lumen of the vesicle. Tumors of neighboring organs, notably the prostate, may displace, obstruct, or distort the vesicles.

Complications of vesiculography include perforation by catheters in the ejaculatory duct method of injection with extravasation of contrast material, infection and abscess formation, acute prostatitis and epididymitis, ascending pyelonephritis, and pelvic suppuration. No mention is made of the incidence of these complications in the author's series.

Thirty-six roentgenograms.

DONALD A. OTTO, M.D.
Detroit, Mich.

Roentgen Examination for the Differentiation of Simple Hypospadias from Hypospadias Associated with Hermaphroditism. E. Schumann. Fortschr. a. d. Geb. d. Röntgenstrahlen **78:** 576–581, May 1953. (In German)

Of the three types of hypospadias—hypospadias of the glans, hypospadias of the penis, and hypospadias of the scrotum or perineum—only the first is likely to be free from associated sexual abnormalities. With the other types hermaphroditism or pseudohermaphroditism may occur. In cases of hermaphroditism, it is impossible to predict in early childhood which sex will eventually prevail. Only the further physical and psychic development in and after puberty will eventually determine to which sex the patient belongs or to which he wishes to belong. If the surgeon attempts to correct the abnormality before puberty, much harm may be done.

The author reports the case of a 14-year-old patient with a hypospadias reaching down to the scrotum. Between the age of five and nine years, nine operations had been performed to close the urethra. No testicles could be palpated in the scrotum. An operation for cryptorchidism was done once but was not successful. The pediatric department had declared the child to be a male. After the age of ten years, two more operations were performed to correct an alleged fistula formation of the urethra. There was a well developed penis but the scrotum was cleft and extended upward around the penis, somewhat resembling the greater labia of a woman. Along the under surface of the penis was a small fistulous opening. It was decided to close this and, on the operating table, air was injected into the fistula. Marked bulging of the perineum occurred and the operation was postponed, the patient being sent to the x-ray department for further study. Radiopaque material was injected into the fistulous opening and the usual procedure for hysterosalpingography was done. The films showed a large pear-shaped cavity under the perineum resembling a vagina. From the upper pole of the cavity, the opaque material proceeded into a triangular organ, which had the typical appearance of a uterus and from there the left tube could be seen plainly filled with radiopaque material. An intravenous pyelogram was also obtained, together with another hystero-

salpingogram. Anteroposterior and lateral views were taken during urination. It could be shown that from the bladder a short urethra went directly into the cavity which had been diagnosed as a vagina. The patient obviously had all the internal sexual organs of a female.

In conclusion, it may be said that only the hypospadias of the glans should be operated on in early childhood. A careful x-ray examination with contrast material may give valuable information about the internal sexual status.

Five roentgenograms; 2 photographs.

Wm. A. Marshall, M.D.
Chicago, Ill.

The Urological Importance of Radiopaque Appendiceal Concretions. George C. Prather and James A. Singiser. J. Urol. **69:** 714–720, May 1953.

Disease of the appendix may closely simulate disease of the nearby ureter. This is particularly true of appendiceal concretions and ureteral calculi. A stone in a retroperitoneal appendix may be seen on the roentgenogram in the position of a ureteral stone and may indirectly produce obstruction to retrograde passage of a ureteral catheter. Conversely, stones in the right ureter may simulate appendicitis and lead to erroneous operations for appendicitis.

Appendiceal concretions average 0.5 cm. in size. They are usually seen on the roentgenogram as smooth, oval, laminated opacities. Differentiation between appendiceal stones and ureteral calculi may require three-dimensional radiographic technics and/or retrograde pyelography or excretory urography. Phleboliths, arteriosclerotic plaques and calcified mesenteric nodes can be differentiated on a basis of number, size, distribution and bilaterality plus a previous history of disease, medication, or injury.

Three illustrative cases are reported.

Five roentgenograms.

Richard F. McClure, M.D.
Palos Verdes Estates, Calif.

THE BLOOD VESSELS

Studies in Peripheral Arterial Occlusive Disease. I. Methods and Pathologic Findings in Amputated Limbs. Stanford Wessler and Monroe J. Schlesinger, with the technical assistance of Marcia Spilberg. Circulation **7:** 641–656, May 1953.

Feeling that there was a lack of basic data on arteriosclerotic changes in the arteries of the lower extremities, the authors devised a technic for injecting the arterial tree (of amputated limbs) with a radiopaque substance and "unrolling" the tissues so as to spread the vessels in one plane for better visualization. Most of the limbs studied were amputated for gangrene, but several because of osteomyelitis or cancer.

Anomalies, occlusions, narrowing, calcification, and collateral circulation were carefully studied in all cases. Significant anomalies were rather uncommon, but in a few instances the peroneal or posterior tibial arteries were absent.

In the 56 cases regarded as successfully injected, radiographed, and dissected, 438 complete occlusions were found, and in all but 2 of these the injection mass had reached the portion of the vessel distal to the occlusion by way of collaterals. Some anastomotic vessels were large enough to be seen and dissected but most were quite small.

Narrowing of the arteries alone did not lead to gangrene, but the amount of narrowing found was greater in limbs which showed more occlusions, suggesting that narrowing probably preceded the formation of thrombi, which grew until the vessel became occluded. Some thrombi were found in areas of narrowing which had not yet reached the point of occlusion.

No correlation was found between the presence of calcification and the sites or numbers of occlusions.

Two main conclusions were reached by the authors in this preliminary study: (1) that the arteries of the lower leg bear the brunt of arteriosclerotic disease in the lower extremity and (2) that the amount of obstruction to the arterial circulation was usually amazingly extensive before gangrene developed (because of the development of collateral circulation).

Technics of injection and dissection are given in detail, illustrated by photographs and x-rays.

Eight roentgenograms; 4 photographs; 1 drawing.

Zac F. Endress, M.D.
Pontiac, Mich.

Selective Arteriography. Detlev Schoen. Fortschr. a. d. Geb. d. Röntgenstrahlen **78:** 600–604, May 1953. (In German)

So far arteriography of the extremities has been more or less limited to the study of that phase of the circulation that exists at the time the films are taken. In order to obtain more information about the function of the vessels, several methods have been proposed.

The author injects the contrast medium after the arteries have been first filled with oxygen, a technic which was worked out by Moeller in Germany and which protracts the filling time of the vessels over a period of several minutes, thus permitting careful fluoroscopic examination. With the patient on a fluoroscopic table in the Trendelenburg position, the femoral artery is punctured and an injection of 0.1 gm. of acetylcholin is made. The purpose of this injection is twofold. First, it will produce a marked widening of the blood vessels. Second, it is a safety procedure: if the injection has been properly made into the artery of the leg, the patient will experience some pain down the leg, but if, through an error, the injection has been made into the vein or if there are extensive arteriovenous anastomoses, angina-like pain in the chest will occur, in which event the oxygen method cannot be used because of the danger of gas embolism.

For the injection of the oxygen, the author uses the apparatus devised by Moeller, which permits the injection under carefully regulated pressure, adjusted so that it is a little higher than the blood pressure.

For visualization of the lower leg, 80 to 100 c.c. of oxygen are used. If the entire leg up to the groin is to be studied, 180 to 200 c.c. are needed. When the vessel is filled, a distinctly audible noise can be heard, and if the syringe is removed from the needle, the whistling sound of the escaping gas indicates complete filling. The contrast medium is then injected. The slow and gradual filling of the vascular ramifications can be plainly followed for a period of about three minutes, which is ample time for careful fluoroscopy.

The degree of the Trendelenburg position controls the time of the filling. If the table is slowly lowered, sometimes little bubbles of oxygen flow back into the contrast medium and a double contrast film of the arteries may be obtained. The oxygen remains within the larger artery for approximately six minutes.

The combination of oxygen and contrast medium injection has not only great diagnostic merit but it is also a therapeutic procedure. An excellent and sometimes lasting vasodilatory effect has been observed following the oxygen insufflation.

The author has been using the method for the visualization of the vessels of the lower extremities only. With proper caution, however, it could also be used in the upper extremities and the oxygen could be injected in the brachial artery. The subclavian artery should never be injected because of the danger of a diastolic reflux of the gas and embolism.

Three roentgenograms. WM. A. MARSHALL, M.D.
Chicago, Ill.

Sympathectomy in Chronic Occlusive Arterial Disease. W. Graham Knox and Herbert Parsons. Am. J. Surg. **85**: 642–647, May 1953.

The authors present a series of 32 cases of peripheral arteriosclerosis treated by lumbar sympathectomy and followed for eighteen months to six years. An analysis of the preoperative findings revealed that age, sex, duration of symptoms and presence of diabetes play a minor role, if any, in selection of individuals for surgery. The status of the peripheral pulses, oscillometric studies, response to oral vasodilator drugs, and paravertebral block were likewise found to be of little help in evaluating patients for operation.

Femoral arteriograms, with Diodrast, were obtained in 17 cases. In 6 there was found patency of the main arteries or adequate collaterals. All of this group had satisfactory results from sympathectomy. The remaining 11 patients showed complete occlusion at varying levels of the femoral artery. Seven patients had had severe claudication but no tissue necrosis, and all but 1 had good results from sympathectomy. In 4 cases with deep tissue necrosis no improvement followed sympathectomy.

Plethysmography was done in 19 of the cases and it was felt that operation should be offered to those patients showing even a minimal response to vasodilators as determined by this procedure.

The authors feel that sympathectomy will yield the best results in patients with intermittent claudication. The poor results seen in patients with tissue necrosis should serve to emphasize that earlier operative intervention might be indicated in cases of peripheral vascular sclerosis.

Three roentgenograms; 2 photographs; 6 plethysmograms. SEYMOUR A. KAUFMAN, M.D.
Boston, Mass.

Catheter Replacement of the Needle in Percutaneous Arteriography. A New Technique. Sven Ivar Seldinger. Acta radiol. **39**: 368–376, May 1953.

A simple method of using a thin-walled polyethylene tube as an arterial catheter for the performance of percutaneous arteriography is described. A needle is introduced percutaneously in the artery at a slight angle. The supple tip of a flexible, round-tipped metal leader is then inserted a short distance into the lumen of the artery through the needle and held in place while the needle is withdrawn. Bleeding is controlled by manual pressure on the artery proximal to the puncture site. A polyethylene tube of the same diameter as the needle is then threaded over the leader, through the skin, and into the lumen of the artery. The leader is removed, leaving the catheter in place in the artery. After good arterial bleeding through the catheter has been obtained, it may be directed to any level required. Since polyethylene tubing is, unfortunately, not opaque to x-rays, a small amount of contrast medium may be injected and followed by a test exposure to insure the presence of the catheter in the artery.

The author reports that 40 arterial catheterizations have been carried out by this method, without the aid of general anesthesia, the injection being made throughout by hand. The tubing used, in all cases, was either No. 200 (internal diameter 1.4 mm., external diameter 1.9 mm.) or No. 205 (1.57 mm. internal diameter and 2.08 mm. external diameter). Catheterization was unsuccessful in 3 patients because resistance to passage of the leader was encountered or sufficient blood flow through the catheter was not obtained. Complications of the procedure were of no significance.

Seven roentgenograms; 2 photographs; 1 drawing.
RICHARD F. MCCLURE, M.D.
Palos Verdes Estates, Calif.

Portal Phlebography by Transparietal Parenchymatous Splenic Injection. L. Leger, L. Gally, and N. Arvay. J. de radiol. et d'électrol. **34**: 322–324, 1953. (In French)

With a lumbar puncture needle, the spleen may be punctured subcostally, if large, or in the tenth intercostal space laterally. Rather rapid injection of 20 c.c. of 70 per cent Diodone leads to opacification of the spleen, followed by opacification of the splenic vein and portal tributaries. By this means it is possible, prior to intervention for the syndrome of portal hypertension or splenomegaly, to locate precisely the venous obstruction responsible for the disturbances. The method has proved innocuous in animal studies and in 6 patients.

Four roentgenograms. CHARLES NICE, M.D.
University of Minnesota

MISCELLANEOUS

Clinical Diagnosis of Generalized Cytomegalic Inclusion Disease. Robert D. Mercer, Sarah Luse, and Donald H. Guyton. Pediatrics **11**: 502–514, May 1953.

The authors present what they believe is the first case of generalized cytomegalic inclusion disease to be diagnosed clinically. The disease has many names, but the present term is considered to be the most descriptive. It is thought to be a specific viral infection occurring *in utero*.

Clinically there are jaundice, thrombopenia with hemorrhagic manifestations, hepatomegaly, and splenomegaly. Variable findings are erythroblasts in the peripheral blood and epithelial cells with specific inclusion bodies in the urine.

Roentgenography in the authors' case revealed small intracranial calcifications similar to those seen in toxoplasmosis. Ventriculography showed these to be related to the ventricular walls. In the long bones there was unusual sclerosis of the shafts, with areas of diminished density at the ends. Films of the chest and abdomen were non-contributory.

Differential diagnosis includes a consideration of syphilis, erythroblastosis fetalis, and toxoplasmosis. The case history and autopsy findings are presented in detail.

Two roentgenograms; 8 photomicrographs; 1 photograph. JOHN J. CRAVEN, M.D.
Cleveland Clinic

RADIOTHERAPY

Nitrogen Balance in Malignant Disease. Norman Bolker. Am. J. Roentgenol. **69:** 839–848, May 1953.

Among the immediate causes of death from cancer, those related to cachexia take the lead. Cachexia is a slow wasting process which enfeebles the patient, reduces his resistance to infection, and slows down metabolism. It has been assumed to be associated with a negative nitrogen balance, that is, urinary and fecal secretion of nitrogen in excess of the intake.

Observations were made on 25 patients with malignant tumors in an attempt to study the magnitude of nitrogen loss, the effects of roentgen therapy on nitrogen balance, and the effect of diet on protein synthesis. Clinical cachexia was present in 15 individuals; 10 were well nourished. The patients were carefully selected so that nitrogen intake and excretion could be carefully studied. The study indicated that a positive nitrogen balance could be achieved when the protein intake, oral and parenteral, reached a high enough level. There was a certain threshold, however, below which an increased nitrogen intake caused an increased nitrogen loss in cachectic patients. This level was surpassed by tripling the average protein intake of the patient. The explanation of this action is not clear; it may lie in the unknown process which precipitates cachexia. Cachectic patients with a low nitrogen intake were shown to conserve nitrogen.

Roentgen therapy uniformly caused an increased loss of nitrogen as reflected by increased urinary nitrogen. This was so in both the well nourished and the cachectic patients. It is thought to be due to breakdown of protein in tissue in the area of irradiation.

Though the cause of the change from the well nourished state to cachexia is not known, it can be recognized by weight loss. The most accurate index of the onset and rate of progress is the nitrogen-balance study. Restoration of the tissue proteins may be attained with improved nutrition. The effect of increased nitrogen consumption, however, has been shown to increase the rate of tumor growth in laboratory animals (White and Belkin: J. Nat. Cancer Inst. **5:** 261, 1945). The application of this observation to man could not be assessed from this study.

It has been noted that there is an increased radiosensitivity of tumors in well nourished as compared to malnourished individuals and that they can better tolerate an intensive course of irradiation therapy. Thus a high level of nitrogen intake may be of value to inhibit or forestall cachexia and so possibly to improve the effectiveness of irradiation treatment with prolongation of the life of the patient.

Seven tables.

SEYMOUR A. KAUFMAN, M.D.
Boston, Mass.

Radium Treatment of Cutaneous and Lip Cancer. J. Körbler, P. Frank, P. Škarica, and I. Buhač. Radiol. clin. **22:** 185–201, May 1953. (In English)

The authors review the results obtained in cancer of the skin and lip at the Radium Institute of Zagreb, Yugoslavia, from 1931 to 1947. Radium filtered by platinum was used superficially or in the form of needles implanted in the tissues, the method and dose depending upon the site and extent of the lesion.

In evaluating the results, it is felt that it is justifiable to exclude patients lost to follow-up and those dying of other causes. To indicate this the term "net healing" is used.

A total of 2,783 cases of cutaneous malignant growth were followed for three years, 2,099 for five years, and 1,353 for ten years. The "net healing" after three years was 79.27 per cent, after five years 73.06 per cent, and after ten years 59.74 per cent. When the results are computed by stages, it is seen that the "net healing" of superficial cancer of the nose and face at three years approaches 100 per cent, decreasing after five and ten years but never falling below 90 per cent. In Stage 4, however, the "net healings" even at three years are under 50 per cent, with a notable drop after ten years.

Cancers in other regions of the head than the face, nose, and eyelids, and elsewhere on the body surface gave less favorable results. For cancers of the extremities the "net healing" rate after three years was 38 per cent, falling to 15 per cent after five years.

The authors found the results obtained in 646 patients treated with short-distance x-ray therapy to be comparable with the results in their radium series but the former method is applicable only in superficial cutaneous cancers.

In the period under discussion 1,155 cases of cancer of the lip were treated. The "net healing" rates were 73 per cent at three years, 64 per cent at five years, and 47 per cent at ten years.

Eight tables.

X-Ray Therapy in the Treatment of Hemangiomas. Wesley W. Wilson. South. M. J. **46:** 464–468, May 1953.

The author has treated 200 infants for hemangioma with low-voltage roentgen rays. In 48 (24 per cent) of this group treatment was started before the age of six weeks, in 116 (58 per cent) before the age of seven months, and in 36 (18 per cent) before the age of thirteen months. The unfiltered roentgen rays were given at 50, 62, and 85 kv., depending on the thickness of the angioma. Except in 2 patients, irradiation was administered at a target distance of 15 cm. The lesions treated before the age of five weeks were given 175 r at weekly intervals for an average total dose per lesion of 525 to 700 r. Those treated after five weeks of age received 200 r at intervals of three weeks for an average total dose of 800 to 1,000 r. Secondary infection developed in only 2 cases, and in both was mild and readily controlled by antibiotics and the roentgen therapy. In 28 patients advanced secondary infection was already present when the roentgen therapy was begun; in these cases a poorer cosmetic result was obtained because of the extensive tissue destruction by ulceration.

The author believes that one should not wait for angiomas to disappear spontaneously, as such a policy may result in trauma followed by infection, ulceration, pronounced scarring, and disfigurement.

Eight photographs.

Simple Scheme for Deriving X-Ray Skin-Surface Dose Times. Russell A. Langley. Arch. Dermat. & Syph. **67:** 484–487, May 1953.

Because of back-scatter from the body tissues, similar air doses of x-rays will result in different skin-surface doses when areas of different size are treated. For this reason, all doses given in dermatologic treatments

should be expressed in skin-surface roentgens (r_0). A system of calculation is presented which makes allowance for back-scatter so that the actual dose to the lesion is not altered by variations in the size or thickness of the field or the quality of the rays used.

A table is provided which enables air dose times to be converted to skin-surface dose times for various x-ray treatment factors. With this method, only a few simple calculations are required after each recalibration of an x-ray plant.

Osteoclastoma of the Petrous Temporal Bone. Report of a Case Benefited by Deep X-Ray Therapy. T. A. R. Dinning. Australian & New Zealand J. Surg. **22**: 253–257, May 1953.

Osteoclastoma of the petrous temporal bone is rare. The author found only 4 cases in the literature, to which he adds 1. The commonest symptoms appear to be deafness, vertigo, pain, and facial palsy. Differentiation should be made from cholesteatoma (epidermoid), the commonest benign tumor of the petrous bone. In the presence of this latter tumor the sixth cranial nerve is not involved since the lesion is confined to the petrous bone. Osteoclastomas, however, may spread to involve the neighboring bones, and this may be an important point of distinction. Otherwise, the roentgen appearance may be indistinguishable.

Osteoclastoma is usually regarded as a benign tumor, but 2 of the 4 reported cases referred to by the author terminated fatally as a result of recurrences following radiation therapy. In 2 other cases, including the one reported here, irradiation resulted in arrest of the lesion.

The author's patient was a girl of eight years, with involvement of the fifth, sixth, seventh, and eighth cranial nerves. A clue to the diagnosis was furnished by roentgenograms of the temporal bone, showing virtual amputation of the petrous apex. Operation was done, but the extent of the tumor prevented its complete removal. Several pieces were taken for examination and, following convalescence, radiation therapy was instituted. This was given through three portals (215 kv., 15 ma., 1.0 mm. Cu and Al filtration). Each of two lateral fields received 2,200 r and a posterior field 2,100 r, the total tumor dose being 2,117 r. A second course of therapy was subsequently given, with a tumor dose of 943 r. Eight months after treatment the lesion could still be identified roentgenographically. At this time it showed increased calcification and slight diminution in size.

Six roentgenograms; 1 photograph; 1 photomicrograph; 1 table. MORTIMER R. CAMIEL, M.D.
Brooklyn, N. Y.

The Roentgenologic Diagnosis and Follow-up of Hypopharyngeal Cancer. Sölve Welin. Am. J. Roentgenol. **69**: 796–802, May 1953.

The author includes under the designation hypopharyngeal cancer all cancers from the vallecula to the upper part of the esophagus except intrinsic laryngeal lesions. For the early diagnosis of these neoplasms, an intimate knowledge of the roentgenologic appearance of the region is necessary. Three planes are chosen for better orientation when comparing postero-anterior and lateral views. These are: (1) the vallecula plane, through the bottom of the valleculae; (2) the Morgagni plane, through the ventricle of the larynx; (3) the plane of the esophageal opening between the pharynx and the esophagus. A suspicious lesion in any one of these views can be located at the corresponding level in the other projection. A familiarity with the normal mucosal pattern is necessary to detect small lesions. Roentgenograms with maximal filling of the hypopharynx and upper esophagus are essential for the detection of Plummer-Vinson's syndrome.

Special skin markers are used to help set up the portals for treatment. At the Radiumhemmet a cross-fire technic with four fields is used. The fields are rather narrow, 3.5 to 4 cm., but extend in most cases from the edge of the lower jaw down to, or often below, the clavicle. The tumor dose is about 5,700 to 6,000 r administered in about a month. Each field receives 2,600 to 3,000 r. Two to four weeks after treatment is begun, a reaction ensues and on roentgenograms one sees a decrease in the soft-tissue mass and a smoothness of the mucous membrane, at first due to edematous swelling. Later there is atrophy of the mucosa, producing a typical picture of smoothed-out mucosal folds, and rigidity and deficiency of elasticity of the lumen during swallowing.

A later post-therapy reaction has also been observed, consisting of an increase in width of the prevertebral soft-tissue shadow and a ragged appearance of the mucosa. These changes have been shown to regress without further roentgen treatment, and biopsy has revealed only necrotic mucous membrane and edema. This late reaction has appeared from three to eleven months after treatment, and must be recognized, as additional irradiation in such cases has resulted in fatal necrotic deterioration.

At the Radiumhemmet, the five-year cure rate has increased from 5 to 17 per cent. It is felt that some of the factors responsible for this improvement are early roentgen diagnosis, carefully localized treatment fields, and recognition of the late reactions.

Twenty-three roentgenograms; 1 diagram.
SEYMOUR A. KAUFMAN, M.D.
Boston, Mass.

The Treatment of Carcinoma of the Esophagus by Radiation Therapy and Surgery. Case Report. Eugene E. Cliffton and Henry N. Blansfield. Surgery **33**: 748–753, May 1953.

A case of inoperable carcinoma of the esophagus brought to a resectable stage by preliminary irradiation is reported.

A 64-year-old man was admitted to the hospital, complaining of progressively increasing dysphagia of three weeks duration. His admission was precipitated by a large "hemoptysis" and the passage of several tarry stools. Barium studies of the esophagus revealed an irregular filling defect 7 to 8 cm. long in the middle third of the esophagus. At esophagoscopy a hard, fixed mass was found 33 cm. from the incisors. Biopsy showed this to be an anaplastic carcinoma. On April 3, 1951, at thoracotomy, an extensive mass with its lower margin 10 cm. above the diaphragm was exposed. It was fixed to the aorta and had extended beyond the confines of the esophageal wall into the hili of both lungs. It was obviously inoperable. Following an uneventful recovery, x-ray therapy was started, a total tumor dose of 6,363 r, through ten ports, being delivered from April 12 to May 25, 1951. There was a rapid therapeutic response, with almost complete disappearance of dysphagia. X-ray examination in July 1951 revealed marked improvement in the appearance of

the esophagus, with disappearance of the intraluminal tumor and increase in size of the lumen. There was still some narrowing thought to be due to stricture, surrounded by a small area of mucosal irregularity suggestive of residual tumor. A second thoracotomy was performed on Aug. 4, 1951. Resection of the distal third of the esophagus was carried out. Histologic examination showed nuclear and cytoplasmic changes compatible with tumor cells affected by x-rays.

Roentgenograms in July 1952 showed no evidence of recurrence or metastasis. When the patient was last seen in August 1952, his weight was stable, swallowing was excellent, and his sole complaint was of incisional discomfort.

Three roentgenograms; 1 photograph.

The Argument for Preoperative Radiation in the Treatment of Breast Cancer. C. L. Ash, Vera Peters, and Norman C. Delarue. Surg., Gynec. & Obst. **96**: 509–521, May 1953.

When the radical operation of the Halsted type was first accepted, it was generally felt that a radical mastectomy was one of the most adequate methods available in extirpating cancer anywhere in the body. Later, however, appraisal of the end-results gradually led to some dissatisfaction.

In the first place, the five-year survival rate for untreated cases varies between 19 and 22 per cent, while radical surgery at highly specialized centers has been able to produce a survival rate of only 33 per cent, and this in a selected group thought to be suitable for surgery. Furthermore, approximately 60 per cent of patients chosen for radical mastectomy were found to have axillary node involvement, with a fall in the five-year survival rate from the 70 per cent to be expected in Stage I to 30 per cent or lower.

These observations naturally lead to a consideration of the causes of death after this radical procedure. It must obviously be assumed that the disease had spread beyond the anatomic limits of the surgical dissection. According to some statistics, 65 per cent of patients with axillary involvement will show either supraclavicular or internal mammary node extension, and both of these zones are, of course, beyond the scope of surgery. Also, 11 per cent of patients without demonstrable axillary involvement will show metastases to the internal mammary chain. In addition to lymphatic permeation and lymphatic embolism, some of the spread may occur by hematogenous routes. This spread beyond the scope of radical surgery would be an additional cause of death. The danger of spreading the carcinomatous cells during the radical dissection of the axilla is also to be taken into consideration. It is pointed out that gentleness and care in operative manipulation are associated with a higher five-year survival rate.

The method of treating carcinoma of the breast by simple mastectomy and postoperative irradiation in order to avoid the possibility of spread of the process in the lymphatics at the time of axillary dissection is discussed. Although the five- and ten-year results are comparable to those of radical mastectomy, the authors have not felt justified in using this method, for several reasons, including the increased incidence of local recurrences in the skin.

The authors feel that the scope of surgical treatment should be broadened to include more patients now placed in the inoperable group. In their experience, this can best be accomplished by employing a combination of preoperative irradiation and radical surgery. Some of the advantages of preoperative irradiation are that the normal tissue will be less receptive to implantation after irradiation and the devitalized cells spread by operative trauma may be innocuous. In using preoperative irradiation, higher tumor doses are possible because the irradiation can be applied more effectively. The post-irradiation fibrosis is effective to a certain degree in devitalizing the cancer cells, and, of course, the ability of irradiation therapy to directly destroy the cancer cells is of prime importance. Among the disadvantages of preoperative irradiation is the increased technical difficulty at the time of surgery due to the post-irradiation fibrosis. This, however, is not felt to be a major problem and the authors have noted no statistical difference in the percentage of primary healing or length of hospitalization postoperatively since starting the use of preoperative irradiation.

This method of treatment (preoperative irradiation and surgery) has been utilized largely for the more advanced cases, with 80 of 116 falling into the Stage IV grouping. Despite this high proportion of advanced lesions, many of which would be inoperable in Haagensen's classification, the five-year survival rate remains at 40 per cent. Of the Stage IV patients, 26 per cent were free of disease at five years and 13 per cent at ten years. These figures represent a marked improvement over the rates obtained with surgery and postoperative irradiation.

The authors summarize their plan of therapy: Stage I, radical mastectomy and no irradiation therapy; Stage II, radical mastectomy with postoperative irradiation if the axillary nodes are positive; Stage III, a combination of surgery with pre- or postoperative irradiation, depending on some of the characteristics of the tumor; Stage IV, preoperative irradiation and radical mastectomy. The treatment in Stage V is primarily palliative, and various combinations of irradiation and surgery may be used as needed.

Three illustrations; 9 tables.

DEAN W. GEHEBER, M.D.
Baton Rouge, La.

Radium in the Treatment of Cancer of the Tongue. Theodore P. Eberhard. Am. J. Roentgenol. **69**: 789–791, May 1953.

The place of interstitial radium therapy in the treatment of cancer of the tongue is discussed by the author. The argument for surgery is based upon the relatively high (28 per cent) five-year survival rate of Butlin (Brit. M. J. **1**: 1, 1909), but surgical figures represent selected patients. A serious drawback to the surgical approach is the resultant deformity and speech defect.

Conventional external irradiation is not effective, but the use of radium bombs or 700 to 2,000-kv. roentgen therapy units has shown promise. Preliminary external irradiation has improved the results of interstitial radium treatment, by cleaning the lesion and causing the edema to subside so that the lesion can be better demarcated. It may also devitalize cells that are dislodged during the implantation and thus hinder metastasis. The direct peroral route is preferred, when possible, as it helps avoid a general mucositis and damage to the teeth.

The optimum linear intensity of radium needles for interstitial therapy has never been clearly demon-

strated. The use of 5 mg./cm. needles is probably not justified, because of the excess radionecrosis of normal tissues thus produced. Intensities of 1 to 2 mg./cm. are safer and more efficacious. The cancericidal dose is about 7,000 gamma roentgens; this should be correlated with the roentgen-ray dosage, and care should be taken that the total dose is not in excess of the equivalent of ten erythema doses.

The technic of inserting the radium needles is probably the greatest cause of failure. The active length of the needles should be at least as long as the diameter of the tumor. Careful consideration must also be given to the anatomy and motion of the tongue. If the needles are not inserted when the tongue is in a relaxed state, then their relationship must be kept in mind when it returns to a neutral position. The position of the needles should be checked with roentgenograms after each insertion. Good anesthesia is another essential for a successful implantation and homogeneous radiation.

The author's series is small and, for that and other reasons, is not suitable for statistical purposes. Eight of 15 patients treated from one and a half to five years before this report were alive and apparently free of cancer.

SEYMOUR A. KAUFMAN, M.D.
Boston, Mass.

Carcinoma of the Cervix—An Experience with the Surgical Treatment. Joe Vincent Meigs. Ann. Surg. **137:** 660–672, May 1953.

As indicated by the title, this paper is an analysis of the results of surgery in carcinoma of the cervix. It is based upon 100 cases, all of Stages I and II (the latter for the most part without extension to the pelvic wall but with vaginal involvement and moderate lateral extension). The operation was a combination of the original Wertheim procedure plus Taussig's operation (Am. J. Obst. & Gynec. **45:** 733, 1943) for removal of the pelvic lymph channels and nodes. Five-year survivals were obtained in 75 per cent of the series.

The author's interest in operation for cervical cancer was stimulated by his disappointment with the results of irradiation, though he still considers treatment with roentgen rays and radium the proper procedure in this disease and believes that with greater co-operation between the radiologist and gynecologist more individualization of radiation therapy will be achieved. "It does not seem reasonable to me," he writes "that a radiologist *per se* can have the insight into the problem of cervical cancer that a surgeon who understands the anatomy and peculiarities of the disease might have.... I believe that on the radiologist's team there must be a surgeon or gynecologist who knows radiation therapy of cervical cancer as well as he does the surgical approach."

Further points made by the author in regard to radiotherapy are the necessity of determining whether or not the patient is radioresistant or radiosensitive and the frequent failure on the part of the radiologist to irradiate adequately the lymph node metastases. In support of this latter point he cites results of irradiation in 12 patients. These indicate that radiation reaction may be present in the pelvic nodes but offer no evidence that this reaction aids in the cure of the patient. "Perhaps with more carefully pointed and given radiation therapy, nodes could be so injured that radiation therapy would become a valuable assistant in the cure of patients with cancer in the lymph nodes. At the present, at least as far as this study is concerned, there is no definite evidence that much value should be placed upon radiation as far as nodes are concerned."

A number of patients in the author's surgical series had "complete irradiation" prior to operation. Some others had less extensive irradiation. In an analysis of the results, it was found that more patients without radiation were living, that more patients with radiation had positive lymph nodes, and that there were more fistulas in the unirradiated than in the irradiated patients. Of a total of 25 patients who had received less than half of the usual amount of radiation, 12 had no tumor in the cervix at the time of its removal. This is considered very important in view of the tendency in some clinics to give larger and larger doses of radiation therapy. It tends to demonstrate that there is present in some human beings something that makes them radiation sensitive as far as their local disease is concerned.

Local recurrence is said to be less likely following surgical excision than following irradiation.

A new surgical and pathological classification of cervical cancer is presented.

Ten tables.

Results of Radiation Therapy of Carcinoma of the Cervix at the I. Gynecological Clinic of the University of Munich in 1945 and 1946. Heinrich Eymer and Julius Ries. Strahlentherapie **90:** 178–182, 1953. (In German)

The I. Gynecological Clinic of the University of Munich reports the five-year cure rate in carcinoma of the cervix year by year from 1934 to 1946. The figures for 1945 and 1946 are as follows:

	1945	1946
Stage I	26/43 = 60%	42/59 = 71%
Stage II	52/113 = 46%	71/136 = 52%
Stage III	51/187 = 27%	117/347 = 34%
Stage IV	0/8 = 0%	0/31 = 0%
TOTAL	129/351 = 37%	230/573 = 40%
Per cent of patients in Stage I and II	44	34

The cure rates are lower than in the preceding years, when total five-year cures of as high as 58 per cent were obtained. This is probably due to the smaller percentage of Stage I and II cases in 1945 and 1946. At this time, early diagnosis and treatment were difficult in Germany due to the sequelae of World War II.

For the entire period 1934–1936 the absolute cure rate was 47 per cent (1633/4003). The rate for Stage I was 66 per cent; for Stage II, 49 per cent; for Stage III, 29 per cent; for Stage IV, 7 per cent.

ULRICH K. HENSCHKE, M.D.
Ohio State University

Is the Five-Year Cure of Carcinoma of the Cervix a Permanent Cure? A Contribution to the Problem of Control. H. Reichenmiller and H. Drescher. Strahlentherapie **90:** 183–190, 1953. (In German)

The fate of 486 patients with carcinoma of the cervix, in which five-year cures were obtained in the years 1898–1937, was investigated. In 240 cases, information as to the cause of death was available: 133 patients died between six and fifteen years and 107 between sixteen and fifty years after treatment. In 43 cases death was due to a malignant tumor. Death from late local

recurrence occurred in 11 cases between six and ten years and in 7 between eleven and fifteen years after treatment. No patient died from local recurrence later than sixteen years after treatment. Twenty-five of the 240 patients died from tumors in other organs, which are believed to have been new primaries.

One graph; 3 tables.

ULRICH K. HENSCHKE, M.D.
Ohio State University

Value of Serial Biopsies Following Irradiation of Carcinoma of the Cervix. K. A. McGarrity. M. J. Australia **1**: 694–698, May 16, 1953.

Serial biopsy has proved to be a valuable method of assessing the radiocurability of carcinoma of the cervix, having a clinically supported accuracy of 90 per cent. In those cases where radium resistance is shown, early radical surgery is undertaken.

The author outlines his system, which consists of biopsy prior to irradiation, and serial biopsies one, two, and four weeks after the first radium application. Either a modified Stockholm or the Paris technic is employed, with the former preferred for differentiated tumors, and the latter for anaplastic ones.

The pioneer work of Glücksmann, together with his histologic criteria of favorability of reaction, is reviewed (Glücksmann, A.: Brit. J. Radiol. **14**: 187, 1941. Abst. in Radiology **38**: 125 1942). The distinction between radiocurability and radiosensitivity is stressed, the anaplastic tumor being the most radiosensitive and also the most likely to recur.

Five- and ten-year results with various methods of treatment at two Sydney (Australia) hospitals are given, and the figures are compared with those of several other institutions. There is apparently little to choose between irradiation, surgery, and combined therapy in Stages I and II. In Stage III, however, there appears to be a greatly improved survival rate when radical surgery is employed. Irradiation cannot be expected to produce favorable results in Stages III and IV, as in the great proportion of cases serial biopsy shows an unfavorable response in these late stages.

Four tables; two diagrams.

C. M. GREENWALD, M.D.
Cleveland Clinic

Furacin Vaginal Suppositories. Their Use With Radiation Therapy for Malignant Pelvic Neoplasms. Jerome Schwartz and Vincent Nardiello. Am. J. Obst. & Gynec. **65**: 1069–1072, May 1953.

Furacin vaginal suppositories were used in 26 women undergoing radium and/or x-ray therapy for malignant pelvic neoplasms. Furacin (a brand of nitrofurazone) is lethal to most bacteria found in vaginal infections, but not to Döderlein's bacillus. Its action is not greatly inhibited in the presence of organic matter such as blood, serum, and bacterial debris.

It was found that use of the suppositories caused a marked decrease in the amount and odor of the vaginal discharge during therapy. It is also believed that, by reducing vaginal infection, they contributed to a better radiation response. Two cases of sensitivity occurred, one (vaginal itching) four days after the use of the suppositories was begun, and the other (vaginal burning and itching) after nine months of use. All symptoms stopped after discontinuance of the suppositories.

Eight illustrations in color.

W. NAFIS, M.D.
Jefferson Medical College

Chronic Myelogenous Leukemia in Children. Jean V. Cooke. J. Pediat. **42**: 537–550, May 1953.

The author reports on 15 cases of chronic myelogenous leukemia in children seen over a period of twenty years. The clinical observations and blood pictures in these cases placed them in the chronic rather than the acute category. The group made up about 5 per cent of all cases of leukemia occurring in children during the same time. Six of the patients were infants, while the other 9 ranged from four to twelve years of age.

Among the infants the principal characteristic of the disease was a constant thrombocytopenia with a tendency to anemia and hemorrhage. Transfusions were found to be of only transient benefit, and the hemorrhagic symptoms resulted in death after a few months. One infant, however, with extremely careful supervision, repeated blood transfusions (10 liters), and small doses of x-ray therapy, was alive at the end of three years.

Of the older children, 4 were felt not to have had careful supervision. X-ray irradiation was given for hyperleukocytosis rather than for symptoms. These children lived for one to two years.

Three children received carefully supervised x-ray therapy. Treatment was given over the splenic area and only when splenic enlargement produced pressure symptoms. Usually irradiation was instituted a year or more after the disease was discovered. The response was rapid and marked at first, but with the passage of time became sluggish and negligible. These children survived four to five and a half years. The terminal stage of the illness was remarkably similar in all instances. Pains in the legs and thighs appeared, followed by severe toxicity, asthenia, fever, and death.

Two children were treated by agents other than x-rays: one by urethane and the other by radioactive phosphorus. These agents were of no benefit, both patients dying within a few months.

One roentgenogram; 3 tables.

PAUL W. ROMAN, M.D.
Baltimore, Md.

Roentgen Irradiation of Uveitis. Clinical and Experimental Results. Carl Fried. Radiol. clin. **22**: 167–184, May 1953. (In German)

The author reports the results of x-ray irradiation of uveitis in over 300 patients, as well as his observations in animal experiments undertaken with a view to explaining the therapeutic effects. When combined with the usual symptomatic and etiologic treatment of uveitis, x-ray irradiation results, in about one-half of the cases, in disappearance of symptoms in a considerably shorter time than is generally observed. Almost 30 per cent of the patients become symptom-free in less than thirty days. In very few cases do symptoms persist for longer than six months. Etiologically no contraindications to irradiation could be ascertained. Tuberculous uveitis seemed to react especially well. X-ray therapy could thus be started before the often time-consuming investigation of the pathologic etiology was completed. Even old and recurring cases were favorably influenced.

In artificially induced uveitis in guinea-pigs the symptoms disappeared more promptly in irradiated animals than in non-irradiated controls. It could be demonstrated experimentally that radiation produces considerable dilatation of the blood vessels of the choroid and, in this way, improves circulation of the

inflamed tissues of the ocular fundus. This radiation effect could be shown histologically even in cases of extensive destruction of the retina.

After using somewhat varying technics in the initial cases, the author finally standardized the treatment, using the following factors: 160 kv., 10 ma., 0.5 mm. Cu + 1.0 mm. Al filtration, 50 cm. distance, field 3 cm. in diameter. Doses of 40 r were given at each of four treatments at four-day intervals.

Six photomicrographs; 3 tables.

ERNST A. SCHMIDT, M.D.
Denver, Colo.

A System of Dosimetry for Rotation Therapy with Typical Rotation Distributions. H. E. Johns, G. F. Whitmore, T. A. Watson, and F. H. Umberg. J. Canad. A. Radiologists **4:** 1–14, March 1953.

The increasing use of rotational therapy, initially with the patient moving about the x-ray source and now with the x-ray source rotating about the patient, has made desirable an elastic but usable isodose measuring system for accuracy of exposures. If idealized contours are used, large errors may be introduced, especially with eccentrically situated tumors.

In rotation therapy the focus to tumor distance and size of field at the tumor are the only constant factors. Skin dosage and the amount of tissue between the tumor and the skin may vary rather widely. The authors have made a comprehensive survey of variations and have arrived at calculations relating dosage rate at the tumor to output of the machine in air. This is called the "tumor-air" ratio. From this, skin dosage can be calculated. Typical distributions for tumors in the cervix, lung, esophagus, and pituitary are given.

Nine tables and 13 diagrams are presented along with mathematical formulas for preparation of the tables. All steps leading to the development of the dosage tables are concisely presented.

[This is an excellent article for those now using rotational therapy and for those not as yet familiar with this technic.—J.P.T.] JOSEPH P. TOMSULA, M.D.
Baton Rouge, La.

RADIOISOTOPES

Production of Multicurie Gamma-Ray Teletherapy Sources. D. T. Green, R. F. Errington, F. C. Boyd, and N. J. Hopkins. Nucleonics **11:** 29–37, May 1953.

This article is a comprehensive description of many of the economic and physical factors involved in the use of various isotopes in multicurie quantities as teletherapy sources.

The desirable physical properties of a source are briefly considered. The energy of the gamma ray emitter should be high to improve the depth dose distribution. It should also be high (above a few hundred kilovolts) to minimize absorption in bone. The weight and cost of shielding increase with energy, though this presents no practical difficulty at the 1.2-mev energy level (Co^{60} radiation). Replacement is considered necessary every half-life and argues for as long a half-life as is economically feasible. The optimum source-skin distance is suggested as 75 to 125 cm. on the basis of maximization of relative depth dose without unnecessary sacrifice of intensity. A source diameter maximum of 5 cm. is proposed on the basis of arbitrary criteria for permissible penumbra width.

The factors involved in pile production are treated in detail. Self absorption in the source, its specific activity, and the pile neutron flux are related to the irradiation efficiency and time. Calculations are described for the irradiation of cylindrical cobalt shells and compared with experimental results. A relation is also developed for the cost of a source of the strength required to produce a desired output in terms of various physical factors of the pile and the cost of unit neutron flux.

A table summarizes for a number of isotopes, in different shapes, the attainable irradiation efficiency, required irradiation time, and relative irradiation costs. A further table analyzes the average annual cost of these various isotopes as teletherapy sources over a ten-year period.

The major conclusion, on the basis of the analysis presented, is that Co^{60} is the most economically feasible source, with costs relatively less then half those of its economic competitor, Cs^{134}. Details of shipping, transfer of source to unit, and other handling problems are briefly described.

Thirteen graphs; 3 tables.

JOHN S. LAUGHLIN, Ph.D.
Memorial Center, N. Y.

The Use of Radio-Active Isotopes in an Applicator for the Treatment of Carcinoma of the Cervix Uteri. Robert C. Tudway. Acta radiol. **39:** 415–422, May 1953.

Treating carcinoma of the cervix uteri with radium always presents the problem of obtaining adequate dosage at points B and C without excessive dosage to point A, the bladder, and the rectovaginal septum. A radioactive iridium applicator is described which, when placed in the vaginal vault along with two intra-uterine iridium sources, one of which is located 2 cm. above the plane of point A and the other 4 cm. above the plane of point A, gives any chosen dose between 5,000 gamma r and 7,500 gamma r to point A and 5,000 gamma r to point B. The iridium applicator is constructed to control overdosage at point A, the rectum, and the bladder, yet to permit dosage at points B and C of sufficient magnitude that external roentgen therapy can easily augment the iridium dosage until a satisfactory tumor dose is obtained.

The type of applicator used is a modification of a Perspex applicator developed by Blomfield at Sheffield, details of which had not been published at the time of this report. Since radioactive iridium emits gamma rays of lower energy than radium, these rays can be shielded with smaller amounts of metal. The applicator is therefore lighter than comparable types of radium applicators.

The timing of the dosage may be either on the Stockholm principle of two or three treatments, each of one day duration, spread over a period up to three or four weeks, or on the Paris principle of five to eight days treatment within less than ten days. In the latter case, about half as much iridium would be used as in the former. RICHARD F. MCCLURE, M.D.
Palos Verdes Estates, Calif.

Irradiation of Cancer of the Uterine Cervix with Radioactive Cobalt 60 in Guided Aluminum Needles and in Plastic Threads. Joseph L. Morton, Allan C. Barnes, Charles H. Hendricks, and George W. Callendine, Jr. Am. J. Roentgenol. **69**: 813–820, May 1953.

The authors present an interim progress report on the development of treatment methods and the early results in 100 cases of carcinoma of the endometrium and uterine cervix and a single case of vulvar carcinoma with vaginal extension, treated by radioactive cobalt 60 interstitially and by contact. The technics and methods of treatment, and the clinical evaluation of the cases are given. The usefulness of a colpocystoproctogram is stressed as a diagnostic aid, as a pre-treatment record, and to help the physicist design the applicator for the individual patient.

The effects of treatment on the bladder, urethra, ureter, and bowel are discussed, and case reports are presented. No severe hemorrhages were encountered. Nylon threads were inserted into pelvic nodes found at laparotomy in 2 cases.

An adequate length of time has not yet passed to allow proper evaluation of the cases, since the first case was treated less than three years ago.

One table. SEYMOUR A. KAUFMAN, M.D.
Boston, Mass.

The Use of Cobalt 60 in Gamma-Ray Therapy. E. M. Japha. Am. J. Roentgenol. **69**: 445–465, March 1953.

The author deals with the use of cobalt 60 in solid form. According to the decay scheme of Deutsch, Elliott, and Roberts (Phys. Rev. **68**: 193, 1945), beta ray emission of maximum energy 0.308 ± 0.008 mev is followed by the emission in cascade of two gamma ray quanta of 1.10 and 1.30 mev, or, as the latest measurements suggest, 1.169 and 1.331 mev. It is this gamma emission, combined with a comparatively long half-life and easy production, that makes Co^{60} the most useful and practical artificially radioactive gamma-ray source.

The interstitial application of Co^{60} is discussed with special reference to the use of 1 mm. diameter wire with an activity of about 1 mc. per cm., inserted in stainless steel sheaths. Various methods of electroplating the wire to furnish filtration and to prevent absorption of the highly toxic cobalt by the tissues are considered and the relative merits of nickel, steel, and gold for this purpose are reviewed.

Calculations were made of the secondary radiation induced in sheaths and electroplated layers in terms of photo-electrons and first order recoil electrons. A factor of 35 microcuries per millicurie of Co^{60} in secondary beta radiation is produced and more than 50 per cent of this is highly energetic (0.6 to 1.25 mev).

The adaptability of linear sources of Co^{60} in carrying out the Paterson-Parker ideas is demonstrated by starting with the higher intensity linear source. The natural decay spontaneously creates low-intensity sources desirable for that method. Radioautographs demonstrate the uniformity of the intensity of the linear Co^{60} needles and comparison is made to radium needles with segmented sources.

The disintegration constants of Co^{60} are reviewed. The ratio of specific dose rates of Co^{60} and radium are indicated as 13.5/8.4 = 1.607. Dosage determinations, dose rate (k = 13.5 r_γ per mc. per hr.), absorption and protection are discussed. Isodose curves for Co^{60} needles and a chart of comparison of gamma-roentgens between Quimby and Paterson-Parker values for linear sources and Co^{60} needles are furnished.

A considerable discussion is included relative to biological effects as determined by butter-bleaching experiments. All patterns obtained for the various sources of Co^{60} and radium show essential similarity.

Twenty illustrations; 4 tables

JAMES E. LOFSTROM, M.D.
Detroit, Mich.

Functional and Histologic Effects of Therapeutic Doses of Radioactive Iodine on the Thyroid of Man. Brown M. Dobyns, Austin L. Vickery, Farahe Maloof, and Earle M. Chapman. J. Endocrinol. & Metab. **13**: 548–568, May 1953.

From a series of over 400 patients treated with radioactive iodine, the authors have reported in detail the histologic and other data on 29 patients who were subjected to biopsy, thyroidectomy, or autopsy at intervals varying from two days to eight years after administration of the isotope (in 25 for hyperthyroidism, in 4 to alleviate heart disease).

Considerable variation in response of the tissues was found from patient to patient and from one area of the gland to another in the same patient. In 10 of the 25 hyperthyroid patients no evidence was found of radiation changes and most of these had persistent hyperthyroidism. The explanations offered are: (1) inadequate concentration of the radioactive iodine per gram of thyroid; (2) rapid uptake followed by rapid release of the radioactive iodine; (3) inability to detect minute radiation changes. Other patients showed telangiectasia on the surface of the gland and extensive fibrosis and scarring.

An interesting finding was that some areas showed bizarre chromatin patterns and irregular outlines of the nuclei and yet were able to function, as shown by autoradiographs. Abnormal cells persisted even in the case examined eight years after treatment. Whether these cells had survived eight years or represented mutated descendants could not be determined. If the latter, then the question of radiation induced neoplasm arises. No such case has yet been reported, but prolonged observation will be necessary.

[The photomicrographs in this article should be reviewed by anyone using radioactive iodine.—Z. F. E.]

Twelve photomicrographs; 2 autoradiographs; 1 table. ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Radiogold Seeds for Cancer Therapy. Ulrich K. Henschke, Arthur G. James, and William G. Myers. Nucleonics **11**: 46–48, May 1953.

The use of radiogold seeds as an alternative to the use of radon seeds is described. The radioactive gold (Au^{198}) is obtained by the neutron activation of gold wire in the Oak Ridge pile. Radiogold emits a monoenergetic gamma ray (0.41 mev) as compared with the numerous energies of gamma rays emitted by radon and its decay products with an average energy of about 0.8 mev. The peak energy of the beta rays from Au^{198} is 0.97 mev compared with 3.17 mev for radon products.

The activated gold wire is obtained in weekly shipments, is inserted into gold tubing to absorb the beta rays, and cut to various lengths to produce seeds of the desired strength.

A number of advantages are cited for the use of radiogold, including ability to cut seeds of any strength desired at time of use, instead of ordering in advance, and absence of gas leakage danger.

Clinically the seeds may be utilized in permanent implantations or loaded in nylon tubing which is threaded through the lesion. The latter method makes regular patterns of seed distribution very convenient. A variation of this technic involves the original insertion of the nylon tube loaded with dummy seeds by the surgeon and later replacement with a nylon tube loaded with active seeds by the radiotherapist.

The authors have made 51 applications of these seeds in 46 patients, including 31 permanent implantations and 12 nylon tube implantations. No unusual reactions have been noted in any case and the clinical regressions of tumor tissue that have been obtained have been comparable to those with other methods of interstitial irradiation.

Two figures. JOHN S. LAUGHLIN, PH.D.
Memorial Center, N. Y.

Iodine-Concentrating Thyroid Carcinomas. A Report of Three Cases. A. Egmark, L.-G. Larsson, Å. Liljestrand, and Inger Ragnhult. Acta radiol. **39**: 423–433, May 1953.

Only a few thyroid carcinomas take up enough radioiodine to justify its therapeutic use. Even in these cases the distribution of the isotope is irregular, and uneven irradiation results. Uptake of radioiodine in the tumor tissue is increased in the absence of normal thyroid tissue and by thyrotropic hormone and Thiouracil. Serial tracer investigations with radioiodine in cases of well differentiated metastatic thyroid carcinoma constitute the only method of finding those suitable for radioiodine treatment. Three such cases are reported.

Case 1: A 56-year-old male had multiple bone and soft-tissue metastases from an alveolar thyroid adenocarcinoma. Tracer studies showed satisfactory uptake in all areas except over the sacrum. Over a period of eleven months the patient received 318 mc. of I^{131} by mouth. An early transient regression in size of the soft-tissue metastases was noted, but progression of the disease was not permanently altered. Thrombocytopenia developed and death occurred from cerebral hemorrhage sixteen months following the initial dose of isotope.

Case 2: A 14-year-old girl had an alveolar thyroid carcinoma with cervical node metastases. Following teleradium therapy to each side of the neck, there was high radioiodine uptake in the metastatic foci. Following administration of 228 mc. of I^{131} over a period of eight weeks there was a temporary regression of the size of the metastases. When a subsequent increase in size was noted, uptake studies showed that further isotope could be given, and an additional 100 mc. were administered. The metastases again decreased in size. One year later the patient was clinically free of disease. A subsequent myxedema required substitution therapy.

Case 3: A 66-year-old female developed alveolar and follicular thyroid carcinoma with metastasis to the scapula. The thyroid and the metastasis were resected. Five years later metastatic foci developed in the eighth and ninth thoracic vertebrae. These were controlled by 4,000 r external radiation divided into two courses eighteen months apart. Five and one-half years after the original resection, metastases developed in the fourth and fifth thoracic and second and third lumbar vertebrae. Following positive uptake studies, an initial oral dose of 200 mc. of I^{131} was given. Studies five and seven months later still showed a significant uptake of the tracer, and 100 mc. of I^{131} were given on each occasion. Four months after the last dose of isotope, no significant uptake was found in the metastases. The patient's pain diminished, but the radiographic appearance of the lesions remained unchanged. One year later she was in good general condition.

Seven photomicrographs; 2 diagrams; 2 tables.
RICHARD F. MCCLURE, M.D.
Palos Verdes Estates, Calif.

Concomitant in Vivo Measurement of Regional Erythrocyte and Plasma Concentrations Using I^{131} and P^{32}. Allen F. Reid and Ben Wilson. Nucleonics **11**: 64–67, May 1953.

A method of measurement of the concomitant concentration of erythrocytes and plasma in a prescribed region by double isotope labeling is described, together with the application of the method to the lung of the dog. The erythrocytes are tagged with P^{32}, which emits strong beta rays and no gamma rays, and the plasma is tagged with I^{131}, which emits both gamma and beta rays.

A bovine serum albumin is labeled with I^{131}. Details of the addition of a phosphate buffer solution containing P^{32} (1.2 mc./kg. of dog weight) to the washed cells obtained from a blood specimen from the dog are given. A 5-c.c. suspension of cells and albumin containing about 400 mc. of I^{131} and 400 mc. of P^{32} for each kilogram of dog weight is injected.

For *in vivo* measurements of concentration in the lung, a brass tube with a thin plastic window is inserted in the chest wall and sutured in place. Counting rates are observed with and without filters of different thicknesses to determine the relative amounts present of beta rays from P^{32} and gamma rays from I^{131}. Similar *in vitro* measurements of the activity of the injected sample and of blood samples, together with the counts of a standard solution, are used to calibrate the *in vivo* measurements. The resulting concentrations determined in the dog's lung are summarized in a table.

JOHN S. LAUGHLIN, PH.D.
Memorial Center, N. Y.

Studies on the Effects of Continuous Exposure of Animals to Gamma Radiation from Cobalt 60 Plane Sources. John F. Thomson, Wallace W. Tourtellotte, Magdalene S. Carttar, Robert S. Cox, Jr., and James E. Wilson. Am. J. Roentgenol. **69**: 830–838, May 1953.

Using cobalt 60 as a source, the authors studied the effects of continuous gamma irradiation on the survival of rats, mice, and guinea-pigs. Dose rates ranged from 15 to 140 r per day. Animals subjected to the lower daily doses showed longer survival periods. A significant increase in frequency of subcutaneous tumors in the rats exposed to 120 r per day as compared to unirradiated controls was also noted.

It was felt to be of interest to compare the survival of rats and mice continuously exposed to gamma radiation from Co^{60} with the survival of those exposed to daily doses of roentgen radiation. It appeared, at least within the limits of the dose ranges studied, that for both species continuous gamma irradiation is about one-half as effective as repeated roentgen irradiation. This

twofold difference can be accounted for in terms of two empirically derived factors of approximately equal magnitude, one relating to specific ionization and the other to time-intensity. The phenomenon of recovery must also be taken into consideration in the attempt to relate continuous gamma radiation toxicity to acute roentgen-ray or gamma-ray toxicity.

Two graphs; 4 tables.

SEYMOUR A. KAUFMAN, M.D.
Boston, Mass.

Uptake of P^{32} by Cardiac Muscle in Vivo. Julian B. Marsh, Gus G. Casten, and Helen F. Elliott. Am. J. Physiol. **173**: 297–300, May 1953.

The incorporation of P^{32} into the inorganic and acid-labile phosphate fractions of dog heart muscle was studied, with a technic of needle biopsy under local anesthesia. It was found that the increased cardiac work associated with muscular exercise resulted in an increased rate of P^{32} uptake and an increase in the rate of isotope equilibrium between the acid-labile and the inorganic phosphate fractions. No such increases were observed in 6 dogs with an elevated cardiac work load following the production of a large arteriovenous fistula.

In 4 of 7 experiments with rat heart slices, the specific activity of the labile phosphate of phosphocreatine was higher than that of the intracellular inorganic phosphate and higher than that of the acid-labile phosphate fraction in all experiments when the tissue was obtained five to fifteen minutes after the administration of P^{32}. The specific activity of the terminal phosphate group of adenosine triphosphate (ATP) was found to be significantly higher than that of the intermediate phosphate group.

Three tables.

Distribution and Retention of Carrier-Free Radioberyllium in the Rat. C. D. Van Cleave and C. T. Kaylor. Arch. Indust. Hyg. & Occup. Med. **7**: 367–375, May 1953.

The study described here was chiefly concerned with the deposition and retention in organs and tissues of the rat of tracer amounts of carrier-free radioberyllium following intramuscular and intravenous injections of Be^7 as the sulfate, the chloride, and the citrate, as shown by radioautography. This requirement necessitated the administration of doses as much as 1,000 times those previously reported. Such doses, however, are still far below toxic levels.

Intramuscularly injected Be^7Cl_2 was found to be practically completely immobilized, Be^7SO_4 only slightly less so, while Be^7 was freely mobilized from the site of injection.

The distributional pattern, as shown by assays of organs and tissues, was different in animals killed at intervals following intravenous injections of Be^7 as the sulfate, the chloride, or the citrate. It is suggested that these differences in the behavior of the several chemical forms injected is a colloidal particle-size phenomenon.

One graph; 6 tables.

Removal of Radioactive Gold Colloid by the Perfused Mammalian Liver. Robert C. Little and Herbert B. Kelly. Am. J. Physiol. **173**: 265–269, May 1953.

By a procedure which is described in detail, the liver of a dog was isolated and incorporated into a perfusion system without interruption of its blood flow. This perfused, bile-producing liver was used to study the clearance of radiogold colloid from blood which had passed only once through the liver. The rate at which the colloid was removed by the liver, when presented with a nearly constant load without recirculation, increased in a nearly linear manner with time and also with the total amount of colloid presented. It was suggested that these findings might result from only part of the hepatic removal mechanism being normally active and that a large dormant portion could be stimulated into activity when needed. No direct relationship was evident between percentage of colloid removed and blood flow. When colloid was presented to the liver for a second circulation, the percentage removed was less than was removed on the first circulation.

Three illustrations; 2 tables.

RADIATION EFFECTS

Fractures of the Femoral Neck After X-ray Therapy for Carcinoma of the Female Genital Tract. Heinz Kirchhoff and Gert Imholz. Strahlentherapie **90**: 199–207, 1953. (In German)

In 1,500 women receiving roentgen therapy for carcinoma of the genital tract from 1944 to 1951, 14 fractures of the femoral neck were observed. They appeared between three and thirty months after the treatment. Lateral pelvic fields were used and skin changes were present in most of the patients.

Three roentgenograms.

ULRICH K. HENSCHKE, M.D.
Ohio State University

Control of Radiation Sickness with Dihydroergotamine. K. Werner. Schweiz. med. Wchnschr. **83**: 431–432, May 2, 1953. (In German)

Of the numerous remedies that have been tried in radiation illness, including calcium gluconate, bicarbonate injections, cholesterol, insulin, vitamins of all sorts, belladonna, adrenocortical hormones, and antihistamines, none has proved reasonably effective. On the presumption that a portion of the radiation effect is a direct one upon the sympathetic ganglia, particularly upon the synapses of Langley, a trial of one of the ergot derivatives seemed worth while. Dihydroergotamine is a newly developed alkaloid which, in therapeutic doses, is of far less toxicity than other known ergot preparations. Its general pharmacologic effect is that of blocking the reactions induced by adrenalin. Its antihistamine activity is variable and inconstant.

Using a water solution of 2 mg. per c.c., the author gave an average dose of 15 drops three times a day, before meals, to 210 patients undergoing deep roentgen therapy. The drug was very effective for the first three days and moderately effective thereafter in relieving the major symptoms. Only 1 patient showed intolerance. Fifteen patients under nitrogen-mustard therapy were also given the drug, and all but 2 obtained symptomatic relief. While not the final answer, dihydroergotamine is considered the best of the remedies now available for treating radiation sickness.

WILLIAM F. WANGNER, M.D.
Royal Oak, Mich.

Effect of Roentgen Irradiation on the Laryngotracheal Lymph Vessels. Claudio Sbernini and Ivo Orlandini. Radiol. med. (Milan) **39**: 463–470, May 1953. (In Italian)

The effects of large doses of x-rays (from 1,000 to 3,000 r) on the lymph vessels of the larynx and trachea of rabbits were studied by lymphatic injection according to the technic originally described by Gerota. The authors found the lymphatic vessels open and essentially normal in their experimental animals. Injection of the lymphatic vessels was also done in the excised larynx of a patient who had previously received a total dose of 6,000 r. The authors conclude that, within the stated conditions, x-rays do not "seal" the lymphatic pathways.

Nine photomicrographs.

CESARE GIANTURCO, M.D.
Urbana, Ill.

Comparison of Pathologic Effects of Radiation in Weanling and Adult Rats. George W. Casarett. Arch. Path. **55**: 393–402, May 1953.

Unreported studies by Noonan at the University of Rochester School of Medicine and Dentistry showed that rats four weeks of age have a mean survival time of approximately three days after a single dose of 800 r total-body x-irradiation (250 kv., unfiltered) as compared with approximately ten days for adult rats. The present author has continued the study, seeking to determine whether or not this difference in survival time can be explained on the basis of differences in degree of histopathologic damage of one or more tissues and whether or not differences in degree of pathologic change can be explained by differences in the amount of unfiltered radiation penetrating to the radiosensitive tissues of rats of such unequal size.

Fourteen adult male rats, weighing from 320 to 458 gm., and 12 weanling male rats, twenty-eight days of age and weighing from 52 to 64 gm., were given a single total-body dose of 800 r (unfiltered). The radiation factors were 250 kv.p., half-value layer 0.34 mm. Cu, rate 85 r per minute (in air), skin-target distance 23 inches. Measurements of dose made in air and intra-abdominally by means of Victoreen r-meters are compared.

Weanling rats exhibited a markedly greater degree of acute illness than did adult rats, ingesting little food or water and showing severe diarrhea, precipitous weight loss, prostration, and high mortality between the third and fourth days. These animals revealed hemoconcentration associated with probable dehydration and presented clinically a shock-like picture.

An explanation for the differences in clinical behavior, physiologic reaction, and mortality between adult and weanling rats was evident in the form of sufficiently greater histopathologic damage of many of the tissues examined, the tissues including intestines, spleen, lymph nodes, bone marrow, testis, and peripheral blood. Pathologic changes in various tissues of weanling rats became maximal at nearly the same times after irradiation, whereas in adult rats maximum changes in various tissues were separated in time, reducing the stress on the animal at any particular time.

The greater cellular damage in weanling rats appears to be related only in part to a greater internal dose-measurement and in part to greater radiosensitivity of many of the tissues examined.

During recovery of adult rats from initial tissue damage, the appearance of hemorrhages in lymph nodes and the progressively declining erythrocyte and hemoglobin concentrations in the blood suggested the possibility of later death by a mechanism different from that apparent in weanling rats.

Two charts; 3 tables.

Effect of X-Ray to the Kidney on the Renal Function of the Dog. Mortimer L. Mendelsohn and Eduardo Caceres. Am. J. Physiol. **173**: 351–354, May 1953.

The study described here was undertaken in an effort to define the physiological effects of x-rays on the kidney, using unilaterally nephrectomized dogs and clearance technics.

Three female dogs were unilaterally nephrectomized and the remaining kidney was labeled by bits of radiopaque material sewed to the capsule. After a 15-week interval to allow for compensatory hypertrophy, two control measurements of renal function were performed, and radiation to the remaining kidney was started. Measurements were repeated at weekly intervals at first, and later as indicated, until the dogs were killed. One dog received a dose of 3,780 r over a 9.5 × 12-cm. port, at 4 cm. depth; the second received 2,750 r over an 8 × 10-cm. port at 5 cm. depth, the third 2,010 r, through two opposing ports of 11 × 12 cm. that were 15 cm. apart. Physical factors were 250 kv., 30 ma., 50 cm. target-skin distance. For the first and third dogs the output was 80 r /min. with a half-value layer of 2 mm. Cu, while for the second dog the output was 137 r/min. with a half-value layer of 1 mm. Cu.

TmPAH (maximum tubular excretory capacity for para-aminohippuric acid) showed a prompt depression proportional to dosage. Following the larger doses of irradiation, the inulin clearance and renal blood flow temporarily increased, and then fell to a comparable and significant degree. TmPAH, in association with compensatory regrowth of tubules, returned to normal, while the inulin clearance remained deficient. These findings suggest that the ultimate damaging effect of large doses of x-rays to the kidney is to whole nephrons and is probably vascular in nature. Tubular function was the most sensitive index of acute radiation effect, but the growth capacity of the tubules soon compensated for any decrements in function.

Two graphs.